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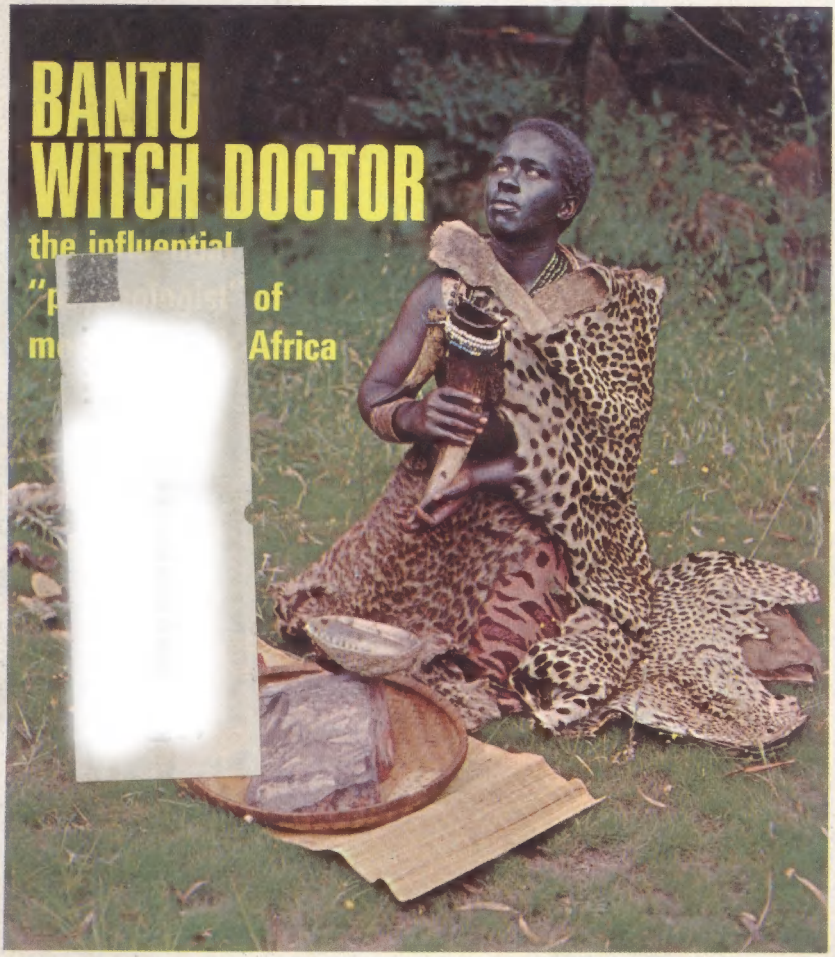

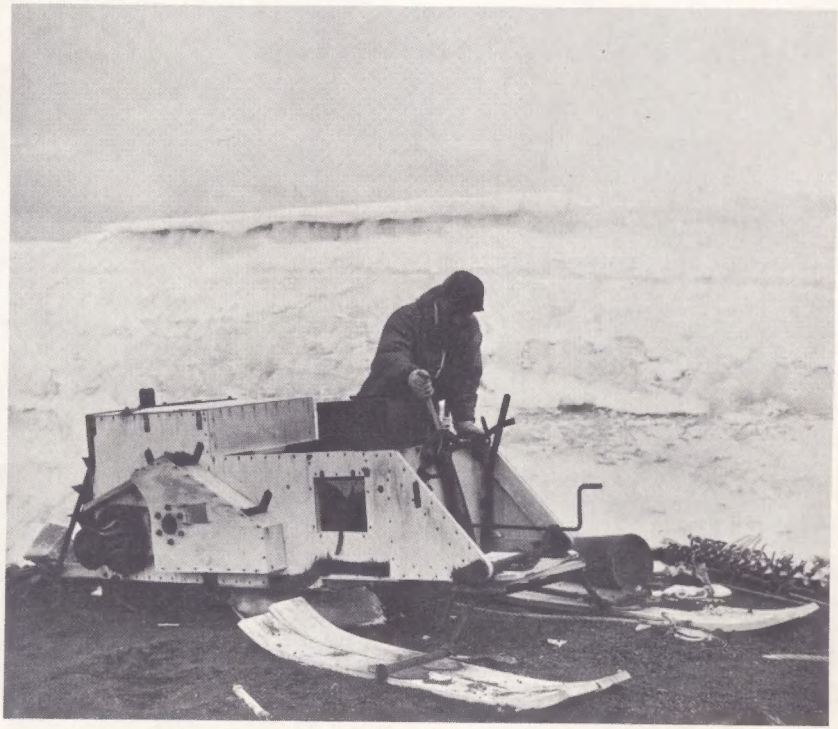

R. F. Dempewolff photo

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Out in front of the Cape Evans shack, near the edge of the McMurdo Sound sea ice, the vehicle shown here sat just as you see it. Except for the motor, which the returning explorers took back to England with them, the snowmobile was completely intact. It was powered by chain-driven spiked wheels in the rear. Scott reported in his diaries that the motor gave them all kinds of trouble, so it was left behind.—*RFD*

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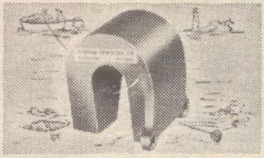

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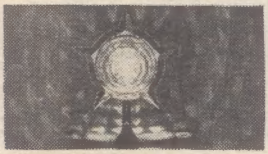

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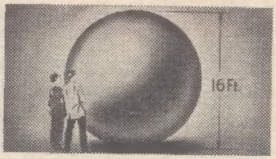

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PROBABLY NO ONE in South Africa knows more about Bantu history and culture than two men who have given their lives to studying it. Dr. A. R. Brink and Mr. Adrian Boshier—Director and Field Officer, respectively, of the Museums of Science and Man in Johannesburg, gave hours of their time and knowledge to provide information for the article about witch doctors on page 6. And the South African government, which was understandably less than steamed up about my asking to interview witch doctors everyplace I

THIS MONTH

went, graciously provided some unique opportunities. All of the pictures accompanying the article were taken by Boshier during his treks across the bushveld where for the past decade he has been digging into Black African cultural history—a subject of growing importance today. Anyone who thinks there was no culture, should spend an hour with Boshier. He has explored the ruins of stone cities built by Bantu; seen and recorded cave paintings and art executed by a people who have been denied credit for them. He has found ancient mines from which the Bantu was taking iron ore with stone tools 43,000 years ago, according to carbon dating of their fires in the caverns! Meantime, Brink and Boshier are busy creating a new idea in museums—a "living museum" in which members of Bantu tribes will live within the museum compound, doing the things their forefathers did—preparing food, skins, performing rites and ceremonial dances. The witch doctors will be there too.—*RFD*

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Hereditary high witch doctor to the Zulu Nation, Vasamazulu Credo Mutwa, shown on the cover, is probably South Africa's most famous witch doctor. The role of witch doctors is so vital in modern South Africa that medical doctors send patients to them. For the inside look at this influential psychologist, see p. 6.

Cover photo courtesy Blue Crane Books, Pty. Ltd., Johannesburg, South Africa.

AUGUST • 1969 Vol. 66, No. 2

CONTENTS

SCIENCE NEWS

Bulletins at Press Time 4
New for People 22
Science Month 35
New for Industry 66

ANTHROPOLOGY

The Secrets That Dead Men's Bones Tell 30

BIOLOGY

Only Trees and Tortoises Live Longer Than People 47

ECOLOGY

Population Explosion: A Warning From the Insects 40

INVENTIONS

A Tunnel-full of Sonic Booms 77

MARINE BIOLOGY

Pearls As Big As Marbles 29

MEDICINE

Prenatal Care and Labor for Fathers . 24
The Realities of Changing Sex 56
Fungus Diseases That Fool the Doctors 81

OCEANOGRAPHY

Fascinating Careers in Oceanography . 61

PHYSIOLOGY

Are You Older Than You Think? 20

PSYCHIATRY

New Parents for Schizophrenics 68

PSYCHOLOGY

Bantu Witch Doctor: The Influential Psychologist of Modern South Africa 6
Your Body Image: What It Tells About You 52

TECHNOLOGY

Safe City: Apartment Living Inside a Mountain 16

DEPARTMENTS

This Month 2
Isaac Asimov Explains 74
Letters 94
Quiz 78
Books 87

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NEWS IN BRIEF/Bulletins at press time

Space Age wine cellar? No, a unit of the new German measles vaccine at West Point, Pa.

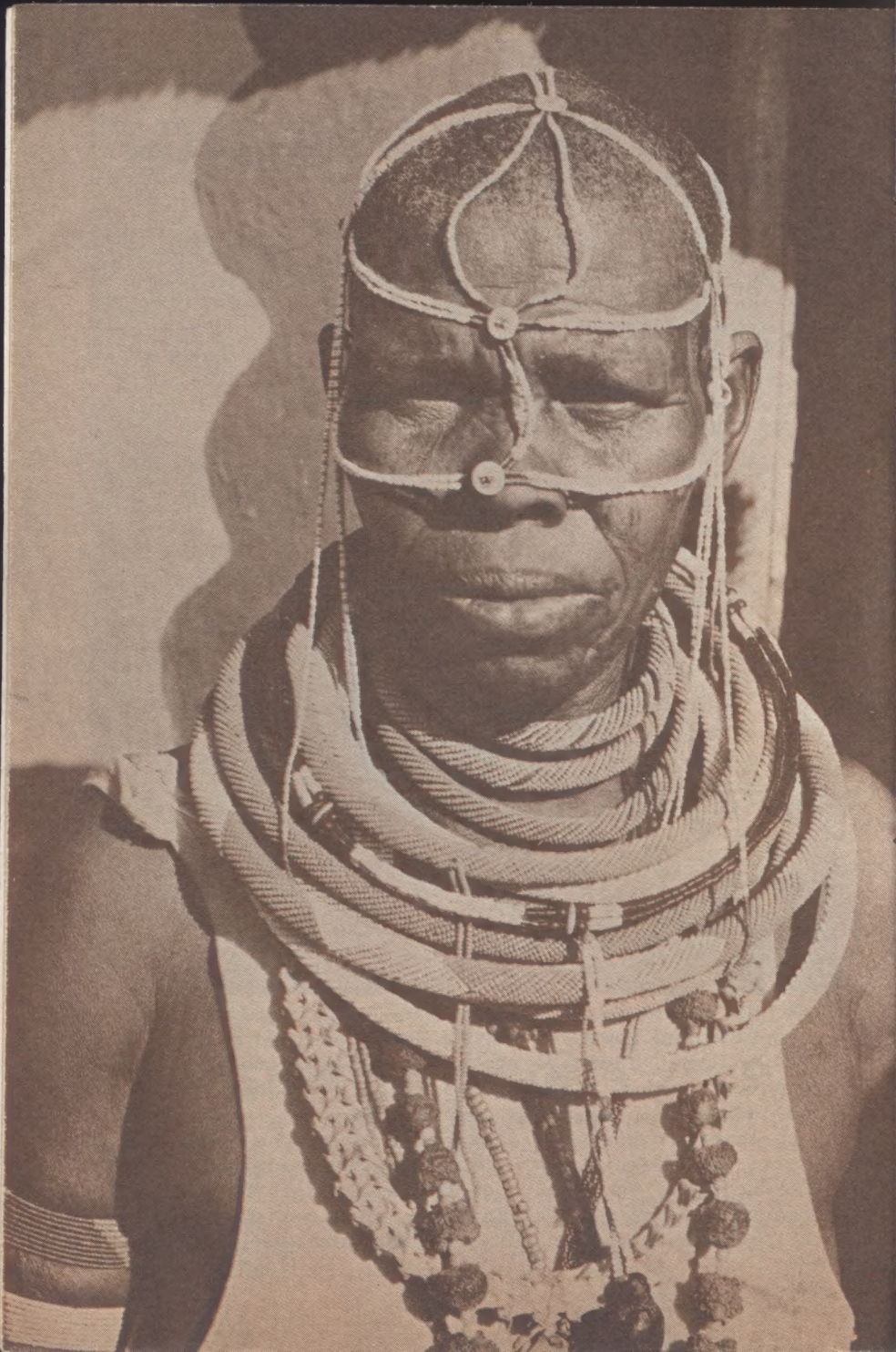
MILLIONS MAY BE SAFE FROM GERMAN MEASLES this month if a new vaccine lives up to its developers' expectations. The disease (rubella) that has been responsible for hundreds of thousands of birth defects and miscarriages in pregnant women has had the constant attention of medical scientists all over the world since its last major outbreak in 1964. The Merck, Sharp and Dohme Research Laboratories of West Point, Pennsylvania, plan to have 2,000,000 doses of the single-inoculation vaccine ready

by the beginning of September. This first batch of the drug will go to children and is not to be administered to pregnant women or to women who may become pregnant within three months after vaccination. Further information is available from your family doctor.

GIRAFFES MAY BE ROAMING THE ARIZONA COUNTRYSIDE if an American geologist has his way. Dr. Paul S. Martin claims that the arid lands of the Southwest and Mexico are the ideal environment for African animals such as giraffes, elands and springboks because the animals like the oily, spiney and woody shrubs that grow there. Dr. Martin suggests that the animals would provide booming populations a prime source of protein which is expected to be in short supply in the future. Wild herbivores similar to the giraffe once lived in the American Southwest some 10,000 years ago.

INFLATING AIR BAG FOR TRAFFIC ACCIDENTS may be the most effective life-saving device in automobiles to date, according to many of Detroit's automotive engineers. In an accident, such as a head-on collision, the nylon air bag pops up, inflates and prevents the passenger or driver from slamming into the windshield. Even though the life-saving bag looks a lot like a large balloon, it is by no means as soft or as fragile. It inflates violently in a split second and has caused bruises, cuts and various other discomforts to some of the people who have tried it out. Developed by Eaton, Yale and Towne Company, the air bag is not yet available for general use.

LIFE IN OUTER SPACE DUST CLOUDS is a distinct possibility if recent observations by radio astronomers are correct. Using the 140-foot radio telescope at Green Bank, W. Va., Drs. Patrick Palmer, Benjamin Zuckerman, David Buhl and Lewis E. Snyder have received radio emissions that indicate the presence of formaldehyde, hydrogen, ammonia and hydroxyl in outer space. The formaldehyde also suggests the presence of methane; all of these substances are considered to be the basic materials for organic evolution. Further support to the life theory is the fact that the substances have been detected in dust clouds that are far enough away to be safe from stars whose radiation is dangerous to organic life.



BANTU WITCH DOCTOR: the influential psychologist of modern South Africa

by Richard F. Dempewolff

SARAH MASHELE is a witch doctor. Her place of business is in the back of her one-story house in Soweto, just outside Johannesburg, South Africa. Through her sparsely furnished waiting room stream scores of "patients" with complaints ranging from painful carcinomas to infertility, impotency and unhappiness in love and life. She is expected to heal them all, but she refers clinical cases to the hospitals; MDs often refer troublesome cases to her. "Unofficially," she says, "because there must be no publicity."

To meet Mrs. Mashele off duty on a street in New York, you'd take her for a modestly well-off, light-skinned Jamaican Negress in her 30s. Her dark, conservative dress and hat and her British-flavored accent would heighten the illusion. Actually, her tribal background is Venda, and she was born in Pretoria.

When divining for or treating patients, Mrs. Mashele wears her animal bladders, skins, beads, amulets and other witch doctor accoutrements. They are highly meaningful to a witch doctor's method, and vitally important in securing the confidence of her patients—half the battle in her profession.

Photos by Adrian Boshier

Risibe Mmapete Mmididi, a Tswana witch doctor of the Transvaal, uses no bones for divining but instead goes into a trance and spirits talk to her. Beads on her head divide her face into physical and spiritual halves.

Recently a distraught Bantu man came to her complaining that he could no longer remember things. A spirit was punishing him in this way, he said. Mrs. Mashele "threw the bones" and read them to find which ancestral spirit had been offended, and what sort of offering would be required to appease it. "But," she told me, with a smile, "the important thing I do is mix the herbs that will clean him out. When the stomach is not working right, that makes a lot of misery in the brain. Then I talk with him and show him tricks to help him remember. And after a few treatments like that, he remembers and is satisfied. He was hounded. Many people are hounded. Africans especially are hounded."

Practically everyone has read books or seen films involving the African witch doctor. He's too colorful to pass up. Unhappily, between badly researched novels, absurd interpretations by Hollywood and confusion with the sorcerer or the "wizard" (whom we'll come to), the average Western impression of him lies somewhere between an evil, potion-mixing Merlin and a gaudily-plumed fraud. While there are "quacks" among them, as there are

in every profession, the dedicated witch doctor is far from a shabby dispenser of evil "spells" and magic stunts. He is frequently a person of status—a politician, advisor to a chief, a successful businessman.

All good ones are knowledgeable and insightful; some are genuine intellectuals. Vusamazulu Credo Mutwa, hereditary high witch doctor to the Zulu nation, is a well-educated author of three highly literary volumes on the folklore and culture of his people. Khotso Masiya, a Transkei witch doctor, is a multi-millionaire businessman sporting a luxurious modern estate, a fleet of limousines and 15 wives. In the kraals on the veld, the witch doctor is less aquisitive, but he is a man apart, feared and looked up to.

To understand the role that the witch doctor plays in modern African society, and why he is still considered essential—even by many South African medical doctors I talked to—you have to know something about the cultural influences of Africa that reach back through oral histories to the beginning of time.

Practically all of black Africa steams in a miasma of hovering spirits. Planting, harvesting, wars, marriages, births, funerals—the outcome of all depend wholly on the good will of spirits, who must be properly acknowledged in specified ritual if one hopes to have good fortune and health. The African knows that every disease has a specific cause; get to the cause and you'll cure it. But instead of laying the blame on infectious microbes, he firmly believes that any illness is a punishment inflicted by an offended ancestral or evil spirit. In some tribes, a family spirit is believed to be offended if a child's face is not scarified with slits according to ritual. The Fengu still believe that the first joint of a babe's little finger must be amputated to keep the spirits happy.

Since a snubbed spirit is responsible, the trick is to find out who's spirit it is and what kind of bribe (usually the sacrifice of a goat, chicken or cow) is required to make it quit. Long dead grandfather, grandmother, father, mother, elder brothers and sisters—in that order—have tremendous influence on everything bad that may happen to a lineal descendant. Evil spirits, like a hairy-limbed gnome called a *tokoloshe* (responsible for unwanted pregnancies), and "wizards," may also bring disease, grief or death to a singled-out victim.

In the center of this bog of hypnotic fear and superstition stands the witch doctor—perpetuator and healing angel, at the same time, of tradition as remote from the modern scene as Tyrannosaurus Rex.

So deeply saturated is the African with his spirit world, and his total faith in the witch doctor's ability to deal with it, that he can perform incredible feats on the latter's suggestive advice.

Dr. Michael Gelfand, professor of medicine at the University College of Medicine of Rhodesia and Nyasaland, cites an incident that occurred during the Nyasaland wars. A Yao chief, fighting the British to preserve his slave trade, was given a medicine that, his witch doctor told him, would make him invisible to the enemy. "The medicine failed, but not the chief's faith in it," reports Dr. Gelfand. "The British soldiers were amazed to see him rushing un-

concernedly into the thickest fire where he soon lost his life."

In the area of psychosomatic illness, however, the same unshakeable faith in the witch doctor has a far more positive effect.

Sarah Mashele can reel off case after case to illustrate the impact of pure faith in healing.

The Bantu servant girl of a white family was bitten by a dog. Her mistress took her to a medical doctor, who sterilized the wound, treated it and injected antibiotics. The girl was sure she had offended her spirits, however, and wanted to see a tribal witch doctor, but her mistress advised against it. Despite continuous treatment, the wound refused to heal. The girl couldn't walk.

"Her mistress went away, and she came here," Mrs. Mashele told me. "It was less than two months when the mistress returned, and this very same servant met her at the airport gate, walking with no trouble." Sarah Mashele had performed the proper rituals, dried the wound with herbs

Old Shangaan sangoma, Johanna Kosa, a woman of great wisdom and knowledge, is instructing Adrian Boshier, field officer of the Museums of Science and Man, as a rare white witch doctor initiate. She is shown above "throwing the bones." Boshier calls her an uncanny diviner. Below is Johanna's set of bones and goatskin pouch in which they are kept. Basic bones of ivory are the carved ones. Domino indicates she's had contact with the white man. Nut shells were inherited.

for the purpose and prescribed a diet. But most important to the girl, the spirits had been appeased.

Dr. H. H. Stott, who runs the Valley Trust Clinic on the edge of the Transkei Bantu lands in Natal, admits that in hundreds of cases of empirical disorders he has obtained complete cures, yet the patient refused to become well. "We had a girl with a simple broken arm," he recalls. "It healed properly with setting and treatment. But after months of therapy, there was a very real inability to budge that arm. She claimed that she knew she had offended an ancestral spirit through something she did, so she went to her village witch doctor. Within a matter of days, she came back smiling to show us how easily and well she was using that arm."

All South African MDs with whom I talked believe that most victims of "angry spirits" go to the witch doctor with classic psychosomatic complaints—aching bodies, paralytic hysterisis, mental turmoil and the like. So successful is the witch doctor in straightening out such ailments that even nonbelievers are sometimes converted. An educated Bantu lad told me that even though he had no faith in witch doctors a few years ago, he had consulted one about a severe rash that the medical doctors couldn't diagnose. The diviner told him that the spirit of his father was offended because the boy hadn't paid him back

Garbed in ceremonial robes, Risibe Mmapete Mmididi is shown here in trance, ceremonial rattle in hand. Mmapete is her principle spirit. Mmididi, a lesser one, also "visits" her.

all the dowry money he'd borrowed before the father died. It was true! The young man was so impressed by the witch doctor's apparent clairvoyance that he paid the money to his father's sister. The rash, he said, promptly vanished.

Just how many African illnesses are brought on by guilt or self-hypnosis because of intense preoccupation with the spirit world, no one knows for sure. Sarah Mashele told me that ". . . for many, many patients the sickness is in the head." Dr. Kleeberg, an MD working on TB virus at the Onderstepoort Veterinary Institute in Pretoria, estimates that about 50 percent of all African ailments are psychosomatic. "And in this area," he says, frankly, "the witch doctors are much better than we are. Those medical doctors who work in the mission clinics can learn much from them."

Actually, the term "witch doctor" is generic. Adrian Boshier, field officer for the Museums of Man and Science, is probably more closely familiar with these fascinating folk than any white man in Africa today. He spent 10 years wandering the veld, living among them and studying them, and is himself an accepted "white witch doctor" initiate of a Transvaal tribe.

"There are at least seven kinds of witch doctor," he says. He lists them as follows: Prophets who foretell the future; diviners who "Throw the Bones" for diagnosis of disease and human troubles; herbalists, who treat ailments with often highly appropriate roots, leaves and bark; rainmakers; story-tellers of the tribal history; philosophers and smiths.

Most common, he says, are those who combine divining with herbal treatment for actual sickness. These are commonly called *sangoma* or *ngoma* in South Africa, or *nganga* in Rhodesia.

How does a witch doctor get to be one? Often it is passed along from father to son or mother to daughter—provided that offspring "have the spirit" (*moya*). An old Shangaan *sangoma,* Johanna Kosa, who is instructing Boshier, has daughters she refuses to teach because, she told him, "There is no *moya;* they are stupid."

Manifestations of *moya* incline to

be erotic and frightening experiences —wild dreams, nocturnal wanderings, fasting, seclusion, involuntary mad dancing, violent illness brought on, some ethnologists believe, by copious use of drugs about which little is known outside the witch doctor fraternity.

In a study made by Dr. M. Kohler, a mission doctor in Natal during the 1930s, nearly all of the hundreds of witch doctors he questioned were "told by spirits" that they must become one. "The call comes in a dream," a typical *sangoma* reported. "The spirit says, 'Go and dig medicine in such and such a place, let it make you vomit and besmear yourself with it; then you will know all things.' "

In Adrian Boshier's case, his *moya* involved snakes. "When I was prowling the veld,' he explains, "I supported myself by collecting venom and selling it to the clinics. The fact that I would handle snakes, and even survived a few bites, impressed the Bantu mightily. They have great fear of snakes, and worship them. Many of their deities are snakes."

Initiates are taught by older witch doctors the properties of herbs and roots, where to find them and how to prepare them. Sarah Mashele showed me her root stores. There were literally thousands she had dug herself. "They are no good if you buy them," she said. Some would be violent poisons if taken internally, but are beneficial externally.

She offered to give me an "injection" that would make me "happy." Since witch doctor injections still are performed by making a knife incision and smearing the medicine (often mixed with dung) on the wound, I declined.

Unfortunately, little work has been done in analysis of the medicinal herbs used by witch doctors. Dr. Gelfand recently attempted to classify some of the roots and leaves used by Rhodesian witch doctors, and reported ". . . where there is no magical basis, I believe there is often an empirical one. I know a *nganga* who treated her own asthma with a stramonium leaf (familiar the world over as an ingredient for medicine used in asthma cases)."

A trainee may spend five years or more, according to Boshier, learning medicinal properties of herbs; the secrets of the wild animals; the workings of men's minds; the etiquette of birth, marriage, death and other rituals. The oral history of tribal culture must be committed to memory verbatim. All of this time he travels on foot across the land, gathering knowledge and souvenirs that will become part of his equipment.

None of a real witch doctor's paraphernalia is without meaning. Each ornament and piece of clothing is a reminder of an event in his life, a place he has been or a symbolic instrument of tribal lore. White beads inspire the spirit; bladders worn on the head strengthen the spirit, the duster switch—which should be made from wildebeast tail —is used in "smelling out" guilty people in tribal crimes.

One *sangoma*, in a photo taken by Adrian Boshier, had a weird arrangement of beads strung over her face. "The face of any real diviner must be split by some mark," he explained to me. "The beads do it for her (see page 6). You'll often find an incised or tattooed line dividing the face in two—the spiritual and the physical. Johanna Kosa has her

face split by a braid of hair from which a cowrie shell dangles.

"The bead rings and strands she wears around her neck are pieces of experience and knowledge she picked up in her travels as an initiate. In recounting her life, she will hold each in turn, like a nun reciting her rosary. I may ask, 'Where did you get this one?' And that will be a long story of her walking 600 miles to the sea, of the tribes she met and the things she saw. And she's got thousands of beads!

"Her garments represent the tribes she is related to. Her main black skirt is the great mother tribe—N'guni, from the north. Under it is a white one, representing the peaceful Shangaan offshoot, of which she is a member. Beneath that is Zulu—a red apron for the blood they spilled."

Most curious of the witch doctor's equipment is the set of "bones" he carries in a goatskin pouch and uses in prophecy and divining. Sarah Mashele "threw" hers for me, on the straw mat of special grass grown and woven by herself for the purpose. Throwing bones is done by cupping them in the hands, blowing on them and dropping them. A complete set has four basic bones—bars of carved ivory, bone or wood. Hers were ribs of lion and leopard, she claimed, marked with ancient symbols—female, male, sacred crocodile and one she didn't know. "No one knows," she said. Four knuckle bones were impala—two from a female, one young, one old; two from a young and adult male. "Nothing from dogs or cows; it must be wild," she said. A set of six old, polished nut shells had been handed down to her. Several other odd

Probably the most famous witch doctor in South Africa today is Vasamazulu Credo Mutwa, hereditary high witch doctor to the Zulu Nation. He has authored three erudite books on the culture of his people. Photo above shows him in full witch doctor regalia. Below, on field trip, he examines Bantu rock paintings.

stones and shells were picked up in her travels. A small cowrie shell was "the woman" (a symbol of fertility) from her pilgrimage to the sea; a large one was "the one who speaks," again female. "That one is the 'mouthpiece,' Boshier later explained. "If it falls face down, the bones won't talk."

Bones are read according to the combination of positions in which they fall. "When you find a good diviner, like Johanna Kosa, it's uncanny to watch her work," Boshier says. He had come across her quite by accident hundreds of miles out in a primitive area of the Transvaal. "She didn't know me from Adam. As I came up to her, her head was down. She picked up her bones and threw them again and again. Finally, she said, 'Someone has come to ask me many questions.' She threw them once more, looked straight at me and said, 'Your head is full of the things I know. . . .' She picked up a knuckle bone. 'This is the bone of the impala ram,' she said. 'This is you; the one that walks by himself far from the herds.'

"Then she threw them a few more times. She told me I was married. It was true, but I denied it. She looked puzzled. She threw those bones about twenty times, then she looked at me and insisted: 'On one of your trips you got a wife. The wife comes up always.' She picked up a bone of carved ivory. 'You have a young boy child,' she said. 'And the bones tell me you had another before.'

"It shook me considerably. It was all true. This woman had never seen me in her life, and had no prior knowledge of me or of my coming to her kraal."

One of the classical jobs of the witch doctor is "smelling-out," or pinpointing, a thief, murderer or other undesirable in the tribal community. In past years, the culprit "smelled out" was usually put to death. While the practice in most African states is illegal, it is done.

Sometimes, the witch doctor is crafty. Boshier reports a case involving stolen chickens. The witch doctor presiding at the smelling-out commanded every African in the area to gather at a specified time. Each in turn was required to place his hands on a blackened, iron-lidded cook pot, in which, he told them, there was a chicken. Then, the witch doctor proclaimed in a loud voice that when the guilty man touched the pot, the chicken would rise and lift the lid off. "Naturally," says Boshier, "the lid remained tight, but an inspection of hands revealed only one set of unblackened fingers: The guilty man had only pretended to touch the pot."

Dr. Gelfand tells of a more standard smelling-out in which a chief called in a witch doctor to identify a group of suspected "wizards" (evil sorcerers specializing in black magic and other dark practices for personal gain) among his people, so that he could banish them. On the appointed day, every soul in the village was made to drink a special medicine prepared by the witch doctor. According to custom, those who vomited were proclaimed innocent. Four men did not, and within a few hours they were dead. Gelfand was called in on the autopsies. "I could find nothing to account for their deaths," he reports. "We were unable to recognize the nature of the poison used." When the witch doctor

stood trial in court, he readily admitted administering the "medicine," but claimed it was an ordinary herb emetic. He stalwartly maintained that the men had died because they were wizards. He drew four years.

There's little doubt that the wizard —often a witch doctor gone bad— is responsible for much of the "bad press" that the *sangoma* has received over the years. His sinister "black magic" is used purely for evil purposes. People who want someone out of the way consult him. Most of his "magic" is rank hocus-pocus, but often involves "medicine" made up of parts of people, taken while they are still alive (it's more potent that way), and parts of corpses dug from the grave. While I was in South Africa, three Bantu were caught selling bits of the genitals of a white man they'd killed to a group of wizards who'd paid $250 for the job. Most Africans live in perpetual dread of him.

Ritual murders said to be performed by the real witch doctor, are one of the reasons that African governments have frowned upon him and his activities. Adrian Boshier, who has discussed this subject with many high witch doctors, says they have told him such practices are not tolerated by the genuine witch doctor—that it is only the wizard who is responsible.

There are, however, other reasons why the witch doctor is not especially approved by officialdom. Although most good witch doctors cooperate with the clinics, they do help to encourage the grim aura of superstition and fear that plagues the African from cradle to grave. Many scientists believe that as long as it exists, there can be little real understanding between the cultures.

One government lawyer told me about a Zulu who was arrested for killing his young wife. The murderer explained, in wide-eyed innocence, that the spirits had ordered him to do it. "She got in my dream," he said. "I told her to get out of my dream. Then next night she got in my dream again, so I had to kill her, or her spirit would rule me."

"What do you do with that kind of murderer?" the lawyer asks.

And for all the genuine good the witch doctor does in healing, there is another side of that coin, too. Onderstepoort's Dr. Kleeberg sums it up well: "In TB, when we arrest the disease, we tell them, 'Take this pill daily for 12 months.' They will go back to the witch doctor and tell him: 'The white doctor has now cured me of the symptoms, but not the cause. You must tell me who is against me—an ancestor, the neighbor so-and-so, or an evil spirit.' Then the witch doctor will say, 'Slaughter a goat,' and he is satisfied. The cause is gone. Now he doesn't have to take the pills. That is why we have about a 25 percent relapse rate.

There is little doubt that the African witch doctor's days are numbered. In many ways it seems too bad. Whatever his faults, the world will never see as colorful or interesting a "head shrinker" again. ■

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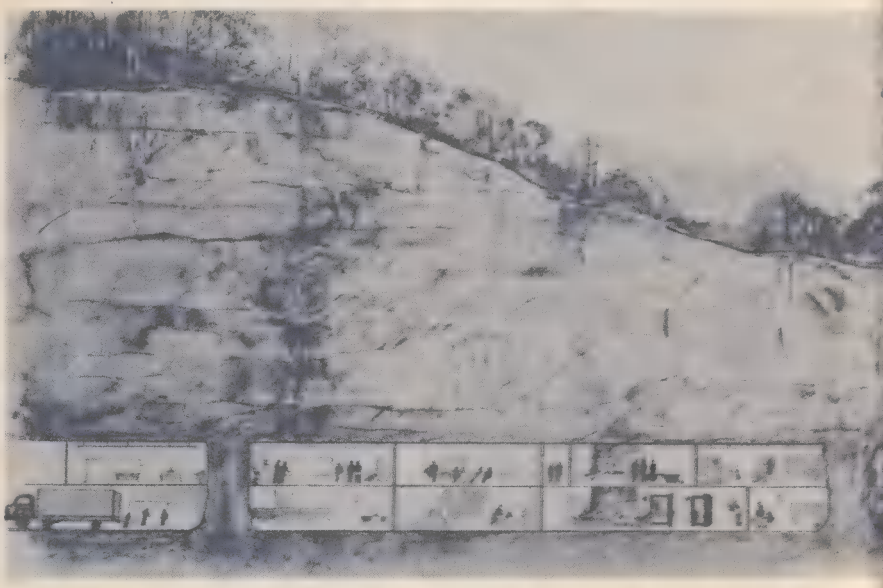

Safe City: apartment living inside a mountain

Underground living is the in thing at "Safe City"—an extensive apartment complex now building 150 feet deep in the rock of a New York mountain. The first tenants in residence say it beats surface all hollow.

by Barbara Ford

DOUGLASS WALKER and his wife, Ruth, spend quiet evenings in their living room—Walker with his stamp and gun collections; Mrs. Walker with her ceramics. English antiques, oriental rugs and flowered love seats grace the large, attractive chamber. The tinkling strains of *Dream of Heaven* waft through the modern apartment from a vintage music box.

It's a typical scene at home for a tired businessman, except for one thing—the Walkers are 150 feet underground. The sole inhabitants, thus far, of what they call "Safe City," they live in a cave near Rosendale, N.Y. It used to be a cement mine. Some day the former mine, about 80 miles from New York City, is expected to provide temporary housing facilities for hundreds, perhaps thousands of executives and their

Artist's sketch shows part of 30-acre city being built underground 80 miles from New York City. It houses records of city firms, living facilities for personnel and families. Keystone Photos

families from the metropolitan area. The vital records of the executives' firms are already being stored in the cave.

Why live in a cave, even a well-furnished one? Safety, particularly from nuclear attack, says Walker. He's the executive vice-president of New York Underground Facilties, Inc., an organization that stores the records of firms underground in vaults for safekeeping. Since there's not much use keeping a firm's records safe if the firm's key personnel are the victims of fallout, New York Underground is in the business of keeping people safe, too.

The Rosendale cement mine is one of the safest places in the United States, Walker claims, and he has a certificate from the U.S. Corps of Engineers to prove it. The Engineers give U.S. Underground Facilities a 1000 rating, their top rating, but admit the mine is even safer than that. A 1000 rating, explains Ken Backofen, sales manager of the firm, means that there's only a 1000-to-1 chance that any fallout will penetrate the underground storage and living areas. The cave has its own power system, sewage disposal and wells, so refugees from fallout should be able to stick it out underground as long as the food holds out. Dried food ranging from pork chops to pudding is being stock-piled.

Walker wants to make the facilities comfortable, even cheery, as well as safe. "I wanted to get away from the usual idea people have about caves—that they're cold, dark, damp places," he told me in his office in New York Underground's new building, which also houses his apartment. The modern two-story edifice looks anything but cold and dark. There are windows, tangerine walls, carpets, a winding staircase, hanging globular lamps. Each room on the periphery of the building has one natural rock wall, the only reminder that you're underground.

Outside, in the open cave area, it's dark and dripping—the temperature is 52 degrees, the humidity is 70 percent all year around—but inside the office building air conditioners and de-humidifiers keep the atmosphere pleasantly springlike.

"The air's a lot better down here than it is in New York," says Walker. "And quiet—listen for a minute." We did and I couldn't hear anything at all, an eerie sensation for someone who spends most of her time in noisy midtown Manhattan.

You drive into "Safe City" through a seven-ton steel door operated by armed guard (top) and enter "Wall Street" area (opposite page), site of three office buildings and an apartment at present. Area is hub of what may eventually be town housing thousands. In offices of New York Underground Facilities, which operates enterprise, Douglass Walker, vice president, works at desk in front of a natural stone wall (right), one of few reminders that you're 150 feet underground. Walker's spacious five-room apartment in same building makes comfortable home for him and his wife (below).

"If you were working here, inside of four hours it would be a different you," he went on. "My wife and I have redeveloped hobbies we had years ago. It forces you to relax."

You drive into Safe City through a seven-ton stainless steel door that opens slowly to reveal a yawning, black cave. After rounding a bend or two, you come into an area that looks like a small street—"Wall Street," the sign says. The area has three buildings at present: New York Underground Facilities, a one-story building occupied by an architect, and a two-story building that belongs to a major chemical firm. Next door to New York Underground is a big open space where a New York City oil company will soon build a facility providing housing for 100 people.

Wall Street is just the nucleus of the future Safe City, according to Walker and Backofen. They envision a city-size complex of buildings within a few years, including stores, restaurants and recreational areas. Hopefully, a nuclear attack will never occur and Safe City will remain largely unoccupied, but New York Underground Facilities is in the business of alerting people to the grim possibility. Usually, they find the topic an uneasy one. "People think about a nuclear attack, but they don't like to plan for it," Walker says. "I ask them what they're doing about it and they can't tell me —it's embarrassing." ■

Are you older than you think?

ARE YOU as old as you feel? As old as you look? Or as old as your birthdate? Within a decade, a new concept in measuring body age may make your *real* age—as contrasted to your calendar years—as common a concept as mental age or I.Q. is today. A valid measurement of body age could lead to changes in insurance premiums, ■ more flexible retirement age and maybe even more May-December marriages between the young-in-calendar-years and the young-in-body-age.

A promising test of body age is being developed at St. Bonaventure University in New York State by Dr. Robert F. Morgan, a psychologist. Called AGE, for Adult Growth Examination, it consists of certain measures of health which change regularly as you grow older. Among them: systolic blood pressure, respiration rate, tremor, visual accommodation, dark adaptation, hearing, pitch discrimination, reaction time, dental changes and glucose tolerance. Dr. Morgan visualizes the final AGE test as comprising ■ number of such measurements, determination of which will take only an hour or two at the most.

Each figure obtained will be compared with age norms collected from a representative sample of the adult population for the same measurement. The comparison may show, for example, that you're younger than average in dental changes, older in glucose tolerance and so on. Your overall average is how old you *really* are. Hopefully, you'll be within a few years of your calendar age or even below it; on the other hand, you may be older than your birthdate. If any area of measurement shows undue aging, you'll probably want to consult a specialist for special attention.

Dr. Morgan has already devised ■ mini-test of just five categories, using norms obtained in a recent Department of Health, Education and Welfare study of adult Americans. The abbreviated test has produced some suggestive results. The average woman, it shows, ages more slowly than the average man until age 40, but in the next decade she actually ages 23 years, thus drawing even with the man at age 50. From 50 to 60, she ages five years faster than a man, and after 60 her body age exceeds that of the male by an average of four years or more. In the five items tested, she aged more quickly in tooth decay and glucose tolerance but held an edge on the male in systolic blood pressure, hearing level and periodontal index, at least until age 50.

Why do women age so quickly in their 40s? Dr. Morgan doesn't know, but he suggests that loss of ability to bear children, problems with adolescent children, marital insecurity and deterioration in looks may play a role in the age spurt.

By dividing the male group into black and white subgroups, Dr. Morgan found that the races are equal in body age at 21 but by age 30,

blacks are five years older in body age than their white counterparts. The differential holds until age 60, when it increases. Black males aged more quickly than white males on three out of four measures tested (hearing level was not available by race), coming out younger only on tooth decay. Again, Dr. Morgan can only speculate on the age gap, but he thinks that the greater effort needed by non-white wage earners to make their way in life, particularly in the first decade of adulthood, might be a factor.

More studies are needed before a standardized AGE test becomes available, but you can already see how old you are in a few areas. In the table below are average scores for adult men and women in systolic blood pressure (SBP) and hearing level at 600 cycles per second (HL). Check your hearing and blood pressure against these values to see how they translate into age scores. Dr. Morgan cautions, however, that a high or low body age based on these two measurements alone is inconclusive and could be misleading. ■

TEST YOUR AGE

Sample items from the Adult Growth Examination: Based on data from the National Health Survey 1962, U.S. Dept. H.E.W.

Scores for Men
WHAT IS MEASURED —
AGE Scores

Scores for Women
WHAT IS MEASURED —
AGE Scores

1. Systolic Blood Pressure (mm. hg.) (average of 3 readings)

SBP Men	AGE
121.7	21
124.7	30
128.6	40
133.8	50
140.3	60
148.0	70

SBP Women	AGE
111.8	21
115.6	30
122.8	40
133.8	50
146.6	60
160.2	70

2. Hearing Level at 6000 cycles per second (db) (for the better ear)

HL Men	AGE
+5	21
+11	30
+16	40
+22	50
+38	60
+52	70

HL Women	AGE
+0	21
+4	30
+7	40
+12	50
+21	60
+27	70

NEW FOR PEOPLE

UPI

TO CATCH A THIEF this handy little device sails through the air for 20 feet at the flick of a switch to envelop a fleeing wrongdoer in 100 square feet of nylon netting. Colin Brown, a Briton who showed the device, called a "thief-catcher," at a recent inventors' exhibit in London, thinks it could be put to good use by banks and post offices to delay a thief until the police arrive. Brown says he invented it after Britain's Great Train Robbery took place some time age.

AUDIO-PROMPTER was invented by a Los Angeles businessman after he lost his vision. Edward J. Meier developed the device which he wears whenever he gives a speech. It consists of a Magnavox portable tape recorder, an earphone attachment and microphone. The earphone button is attached to a pair of glasses. While he delivers the speech, he listens to his voice reading the same speech. He can stop and start it to add extra material.

UPI

PASS YOUR CIGARETTE through this metal "smoke ring" and the resulting wrinkles or ridges will allow indrawn air to bypass the volatile gases at the burning end, says its inventor. Some medical authorities say that these gases at the burning end of a cigarette are a health hazard. The smoke ring has ■ hole machined to a size thirty- thousandths of an inch smaller than ■ cigarette's diameter.

Pictorial Parade

PEDAL-POWERED SUBMARINE (right) is the first of its kind. Says Vernon Hobbs, its British inventor, "I can't imagine why somebody hasn't thought of it before." The pedals will carry the sub to depths of 25 feet. Unpressurized, the vehicle is supplied with air by a "lung" floating on the surface. It can also be pedaled on the surface like a motorboat or sailed like a sailboat at six knots.

X RAY DETECTOR has little red beads inside that let you know if your color television set is emitting dangerous radiation, according to its manufacturer, Circle Square of Phoenix, Ariz. Just shake the device until the electrostatically-charged beads are floating inside their plastic chimney. If they fall to the bottom, X rays are present. The length of time it takes the beads to fall indicates the intensity of the radiation that is being emitted.

Prenatal care and labor for fathers

What's a father to do in the delivery room—be moral support for his wife or a nuisance to the obstetrician? No one seems to agree on Dad's proper place.

by Gail Sullivan

THERE HAS BEEN a traffic accident. Cars traveling 70 miles an hour slow down to 30. Heads turn sideways. People want to see. At the local theater, the camera zooms in for a close-up of a person's throat being cut. The blood splatters across the screen. Outside, a long line of

people waits patiently for the next show to start. Two miles away, a woman is having a baby. She wants to know if her husband can be with her in the delivery room. Permission is refused. "I'm sorry," she is told, "he might faint at the sight of blood."

Fainting. Panicking. Interfering with the doctor. These and many other reasons have been used to prevent the husband from entering the delivery room. The number of hospitals where the husband is encouraged to stay by his wife's side is relatively small. Equally in the minority is the number of husbands who wish to take advantage of the hospitals which have relaxed their rules.

What are we to believe? Do men really get cold feet at the thought of childbirth? What makes some physicians crusade for more husband participation, while others protest that two's company, three's a crowd? The questions are simple, but as with any controversial subject, the answers are mixed, muddled and often misunderstood.

"You can't expect a husband to look upon his wife as a medical subject," one doctor will say. "He's likely to get upset if he thinks his wife is going through too much discomfort."

"It's ridiculous," another doctor argues. "They allow the man to go into the labor room, where he's supposed to accept and watch the longest part of his wife's ordeal, and yet when it comes to sharing the time of fulfillment, those magnificent moments when the child is actually born, he's told that his place is in the waiting room; it's unreasonable for any delivery room to be out of bounds."

"If the man should faint or get sick, then we'll have to turn our attention away from the mother. It's not worth the risk, says another."

"I've been working 20 years in hospitals," says Mrs. Neva Tracey, a supervisor of a maternity ward, "and I've yet to see a husband faint. In all that time, I know of only two who became unwell, and they quietly left the room without causing any disturbance."

But sadly, men haven't always been able to stand up to the experience with sufficient dignity. There was the memorable episode of the husband who fainted in an Illinois hospital, and on falling broke his two front teeth. Just such instances have prompted certain cartoonists and physicians to draw a sorry picture of the father-to-be.

Father—friend or foe

Even when babies were born at home, and the man of the house was sometimes around for the event, he wasn't always the doctor's ally.

"Mind you, I only had one husband who caused me any trouble," recalls the now retired Dr. John Ohanneson of Alameda, Calif. "It was back in 1925, just after I had first started practicing." As he remembers the incident, his eyes crease with laughter. "I was having to administer chloroform to a woman who was having her baby at home in her basement apartment. The sight of it all seemed to disturb the husband, but it wasn't until I applied forceps for the delivery that he tried to interfere. Convinced I was harming his wife, he flew into a rage and grabbed my arm. At that crucial moment, I had no alternative but to forcibly

push him away. I heard a crash behind me but couldn't look up. A couple of minutes later the baby was born. I then had to go outside and attend to the husband who had fallen through the window and broken his arm!"

Fear of lawsuits

In those days, fortunately for Dr. Ohanneson, lawsuits were not a common practice, but today, the fear of being sued is an ugly worry shared by many physicians. Some particularly don't like the idea of a layman being present in their domain. "Misunderstandings can too easily occur," they say. Other physicians, however, express a completely different viewpoint. They feel that when the husband can see what's happening, and if the physician takes a moment to explain what is being done, it's far easier for the husband to accept and appreciate all the circumstances involved.

Backing the latter theory is a lengthy brief regarding husband participation which was submitted in 1963 to the State Attorney General in Sacramento, Calif. It reports, after documenting evidence from hospitals all over the United States, that out of 45,000 deliveries with the husband present, there was not one malpractice suit (not even from the man who broke his teeth) and even more important, there was not one infection traceable to the practice—yet another misgiving echoed by the critics.

But let us consider the parents. Are there any reasons for *encouraging* more husband participation? Physicians such as Dr. Pierre Vellay, author of *Childbirth Without Pain*, believe that not only should the practice be encouraged, but that the husband's presence is indispensable. Dr. Vellay declares, "During pregnancy and preparation for confinement, the husband is an effective manager. He is, moreover, a link between his wife and the obstetrical team. This intimate collaboration has a corollary: it reinforces the bonds between the couple and their future child. The attention of the husband, his understanding, his kindness enormously facilitate the pregnancy of his wife." Dr. Vellay adds, "I have not seen any husbands feel uncomfortable, but I have seen many wipe away tears of emotion at the birth of their child."

Is togetherness enough?

Dr. John A. Kerner, of San Francisco, chief of an obstetrics and gynecology department, holds the same opinion. "As a physician I can offer a woman advice or encouragement. I can even try to cheer her or console her. This is fine, but it doesn't compare with the wholehearted attention and love a husband can give his wife. It's his emotional support that's vitally important to a woman at the delivery of their child."

A favorite argument of the advocates is: "A married couple has to face all kinds of experiences together, both good and bad, so why shouldn't they share this experience? Why should they be torn apart during a crisis like childbearing—surely the most important moment in their married life?"

Then there is the question of whether husbands need to be educated about childbirth at the same level as their wives. Even if the hus-

Mothers shouldn't look upon childbirth as a performance in which they must prove themselves.

band has no wish to enter the delivery room, there still seems to be a necessity to educate him, if only to help him appreciate the marvel of birth. Certainly, the development of his baby is far more intricate, far more spectacular, far more beautiful than anything machine-manufactured. Yet ironically, too many men dismiss childbirth as something that concerns women only. Emotionally they remain detached until the baby is born. To discourage this, several daytime prenatal courses have been switched to evening hours so that husbands can more readily attend.

But it's when the wife wishes to have her baby by natural childbirth that the couple truly has a chance to work as a team. The husband, in the role of a coach, can help his wife practice the natural childbirth techniques in breathing and relaxation. If conditions allow it, he can be her biggest help in the actual delivery room. It's here that the strongest contractions recur at frequent intervals, and it's at this time that his wife needs all possible aid.

After such shared experiences, it's not unusual for the husband to boast, "*We* had a baby."

A happy ending? Joy. Love. A closeness that before was never thought possible? Not always. Take the husband who walked out of the delivery room saying, "Is that all there is to it? Gee! Next time I'll stay home and watch television."

Then there is the opposite extreme. Once in a while, the physician has to face the over-enthusiastic husband. He's the one whose wife has prepared herself to deliver the baby without anesthesia, and yet it becomes obvious as labor progresses that anesthesia would help her. Although this man means his wife no harm, he becomes so concerned with the method, that he objects to what he believes is "false" help.

Preparing for 'the' moment

Dr. Gilbert Webb, of San Francisco, also a chairman of a department of obstetrics and gynecology, explains how the woman can also create the same type of problem. "Sometimes," he says, "the wife becomes far too concerned with putting on a 'good performance' for the husband. Great harm can be done if the woman looks upon childbirth as a test which she has to pass with flying colors. There was one case," he continues, "where the woman had decided to have her baby by the Lamaze method (a method which *prepares* mothers for natural childbirth without anesthesia, but does not dictate anesthesia can't be administered if desired). But this wife," Dr. Webb says, "went literally by the book . . . dozens of books! She read everything there was to read about natural childbirth, and by the time the baby was due she felt she had intellectually conditioned herself to the whole experience. What she hadn't taken into consideration was the big difference between intellect and human emotion. During the birth it became necessary to give her a slight amount of anesthesia. This, to her, meant she had failed

. . . even though she had a perfectly beautiful baby. In her eyes, the failure became even more traumatic because her husband had witnessed it."

Dr. Webb, in giving this example, is not trying to belittle natural childbirth, or argue against husbands being in the delivery room, but he is trying to stress that childbirth is not an experiment to prove how much or how little pain one can stand. "It's not," he says gravely, "a show a woman puts on for an audience, hoping for applause; nor should she be frightened the audience might criticize her for the way she acted. All a woman should be concerned with is having a healthy baby by the method that's best for her."

Pros and cons go on and on

Ultimately, the question cannot be one of whether a husband "should" or "shouldn't" enter a delivery room. The subject is overwhelmingly a matter of personal opinion. Physicians who dislike the idea of husband participation will always be able to cite the case which seems to substantiate their argument against the practice. It takes only one weakness to promote a thousand "ifs." They can even point to the perverted reasons why some couples want to be together, such as the wife who's so resentful about the discomfort she has to go through, she only wishes her husband there so she can punish him. One also hears comments about how husbands might find it shocking to see their wives subjected to that "undignified position" in the delivery room. Sadly, many couples still secretly consider childbirth a disgusting, upsetting experience.

But what is truly unfortunate is that although these negative attitudes exist, they're too often quoted as the attitudes of the majority. For instance, this is a statement made by one girl at the medical society of a residential community. When asked why none of the local hospitals allowed husbands in the delivery room, she said,"Well, they're a detriment. Besides women don't want them there."

The wife in this community who *does* want her husband with her will have to change her physician and travel 20 miles or more to the nearest city hospital which will permit couples to stay together. This isn't an ideal situation.

Perhaps the only rational argument left is whether the hospitals ought to have so much power to say "no." Admittedly they have their reasons for not opening the delivery doors to all couples, but as one physician, Dr. John S. Miller, notes, "It is wrong for us to psychoanalyze couples. Our job is to serve them, not to judge them."

True, if the final decision rests with the couple, many fathers will still prefer the waiting room—or television—but many more couples will get the chance to cherish the shared moment of childbirth as the most meaningful and thrilling event in their lives. ■

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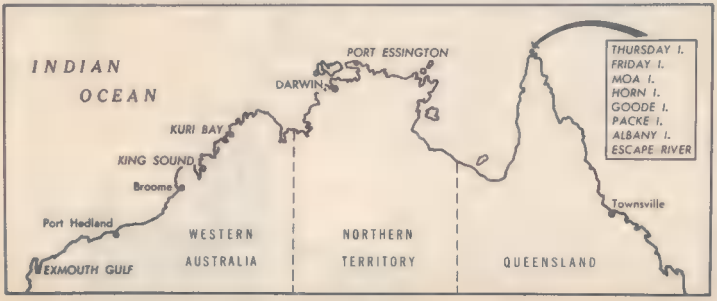
CHILDBIRTH WITHOUT PAIN. *Dr. Pierre Vellay. Dutton, 1960. Hutchinson, 1969. Available through ICEA Supplies Center, 208 Ditty Building, Bellevue, Washington, 98004.*

Pearls as big as marbles

PERSUADING OYSTERS to grow pearls is a real talent, and some Australian "farmers" along that country's northern coastline (see map below) really seem to have the knack for this sort of thing. They're harvesting pearls as big as marbles, and in only two or three years—half the time it takes in Japan, where pearl culturing was perfected. But the Japanese have been instrumental in establishing the industry in Australia. A group of expert operators were brought from Japan to work the first Australian "farm." One laborer is shown at work here. He puts the mollusk in a clamp, and with special scissors makes a small cut in the mantle or fleshy part of the oyster. Then he makes one-eighth-inch square in it and places the nucleus in the oyster. He covers the nucleus with a piece of the mantle, sprays it with a drug and closes the shell. The nucleus will act as an irritant and the oyster will coat it with nacre to form the cultured pearl. The oyster is returned to the mater, checked in two months and once again immersed for two years. After that—the harvest. Proof of what a harvest can bring is the necklace below containing 29 pearls which sold for $100,000 in New York.



ANTHROPOLOGY

It's not mumbo-jumbo that these men practice—it's cold, hard science. Physical anthropologists can now "read" bones—even ancient ones—and tell how and when a person died and more.

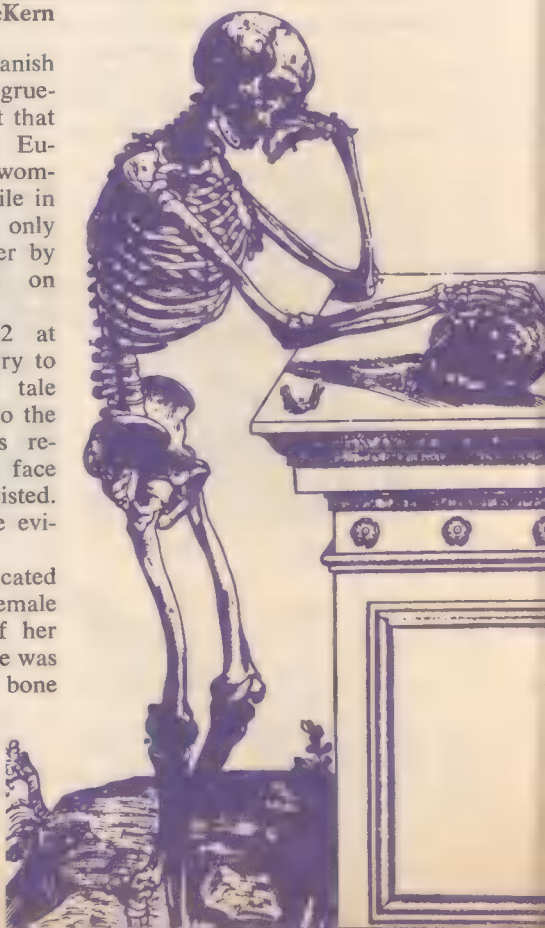
The secrets that dead men's bones tell

by Sharon S. and Thomas W. McKern

For more than 150 years, Danish spines have tingled over a gruesome horror tale. Legend has it that Giertrud Bodenhoff—one of Europe's wealthiest 18th century women—was buried by mistake while in a state of suspended animation, only to be bludgeoned to death later by ghoulish grave-robbers bent on stealing her jewelry.

Scientists gathered in 1952 at Copenhagen's Assistens Cemetery to determine whether the grisly tale was fact or fiction. Digging into the crypt said to hold Giertrud's remains, they found a skeleton, face downward and convulsively twisted. The skull, heavily dented, bore evidence of a crushing blow.

Scientific age assessment indicated the skeleton belonged to a female aged about 19 at the time of her death; Giertrud was 19 when she was buried. A mandible or jaw bone



Bettmann Archive

Famous woodcut (right) by young artist Stephen van Calcar appeared in *De Corporis Fabrica*, a human anatomy textbook written by Andreas Vesalius and published in 1543 in Paris.

found among the remains matched perfectly the slightly underhung jaw which characterized Giertrud in contemporary portraits. Science and legend agree: Giertrud was murdered in her coffin.

It may be true that dead men tell no tales. But their bones speak —loud and clear. The skeleton tells its own detailed story, relating the facts of age, sex, race, body build and duration of interment—as well as numerous diseases and injuries suffered during life and, often, the cause of death. When the body dies, the flesh is soon gone, but the skeleton endures long after—an entity as distinctive of its owner as his vanished fingerprint. A comprehensive analysis of bone can lead to personal identification of human remains even in the total absence of clothing, personal effects or human tissue.

Skeletal identification is a specialized sort of work, and few people are trained to perform it. Because of a background in anatomy, osteology and race studies—and because of much experience in handling large numbers of skeletal remains—the physical anthropologist is uniquely qualified to "read" unearthed bones. He's called in whenever ordinary means of identification fail—in cases of burning, drowning, dismemberment, mutilation and mass disaster. In short, the "bone man" works on bones that are long dead—in archaeological excavations and historical burials—and where decomposition is so advanced that fingerprints and scars are useless for identification.

The anthropologist's interest may be historical, as in the case of Giertrud Bodenhoff, or the bones reputed to represent the remains of St. Peter, which have long been the subject of anthropological speculation (see *Science Digest*, December 1968). The bones of Richard, Duke of York and his brother, Edward V—said to have been murdered in 1483 in the Tower of London—have been positively identified. And the remains of other historical persons—among them, Dante, Bach, Kant, Richelieu, Cromwell and Shakespeare—have been exhumed and examined in order to verify their authenticity. This has been accomplished with varying degrees of success. But the identification of skeletal remains is hardly confined to historical problems. Human bones turn up almost constantly, often under the most curious circumstances. Police are understandably anxious to identify them.

In a routine case, police in a small Massachusetts town found a scattered heap of bones near the local cemetery. No clothing or personal effects were located; the bones were shipped off for expert identification. Examination indicated that the bones were those of a male aged 60-65 years at the time of his death. Living height, determined from the leg bones, was estimated at 5'7", give or take a half-inch. Elbow and spine bones showed signs of advanced arthritis. An immediate check of missing persons lists revealed the six-month absence of an elderly man, 5'7" tall, with a crippled left arm and stiff back. Quickly, the dentist of the missing man was located and asked to supply dental records for his former patient. The records matched the teeth of the skeleton

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and identification was established.

This sort of skeletal assessment is possible because the skeleton, as a living organ, develops with the body. Individual bones support and are supported by the muscles which surround them. Body structure both shapes the skeleton and is shaped, in turn, by skeletal development. This is why sexual differences appear in skeletal remains—the function of childbirth results in characteristic skeletal development for females.

Age is determined through an analysis of the teeth, skull and long bones, as well as a consideration of a "combined maturation pattern"—a check of numerous bones to pinpoint biological age events. The skeleton acts as its own timepiece, registering age changes as they occur. Long bones—those of the arms, legs, fingers and toes—begin as three separate pieces: a middle shaft and two ends of *epiphyses*. These grow together at known rates and fuse into single bones at known intervals.

Dr. Wilton M. Krogman, perhaps the greatest of identification experts, has established the facts of identity from skeletal remains alone in literally thousands of cases. He tells of a young Indian-Negro who ran away from his Oklahoma home in the early 1920s, only to be killed a few weeks later while trying to leap aboard a running freight. His remains were buried beside the railroad, and the case was forgotten until, several years later, oil was discovered on lands allotted to the boy. Before his parents could collect funds due the boy's estate, definite identity had to be established for the buried remains. In 1929, the boy's skeleton was exhumed; an investigator for the oil company judged it to represent an adult male over 30 years of age, arguing that it could not then be identified as the missing heir. Dr. Krogman, however, proved through extensive gross examination and X ray analysis that the bones represented a young male aged 18-19 years; even further, he demonstrated, on the basis of skeletal proportions and certain facial traits, that the bones indicated an Indian-Negro ancestry. This evidence resulted in a court verdict in favor of the boy's parents.

In December 1941, the extensively-burned body of an adult male was found at Schiller Park near Chicago. A local black woman positively identified the body as that of her missing spouse in order to collect life insurance benefits. Dr. Krogman showed that the burned bones represented a 50-year-old, white male, 5'7" to 5'8" tall and of slender build, a description that could not fit the missing spouse. Dr. Krogman was unable to find a clinical cause of death, but he reasoned that such destruction by fire would require either intense heat over a short period of time, or considerable heat over a longer period. The first condition could not have resulted from an open fire in the woods; the second carried with it a high risk of discovery for someone openly burning a human body. Dr. Krogman concluded that the body might have been burned elsewhere, then placed on burning logs in the park to disguise the murder. The body has never been positively identified. But the missing husband turned up.

Scientists derive identification techniques from detailed study of the few available skeletal samples for which age, race and sex are known.

The famous Todd Collection which includes more than 3,000 skeletons, has been the source of numerous techniques.

Additional methods have been formulated through studies of American war dead. It's interesting to note that the United States is the only world power which seeks to systematically identify and repatriate her war dead. Other nations, including our allies, favor mass burial, often behind enemy lines. The U.S. tradition of repatriation for humanitarian reasons also has made possible the accurate determination of identity in an overwhelming majority of recovered fatalities. Because each individual receives meticulous and separate attention and because detailed records are kept of skeletal variations, scientists have been able to refine techniques which can also be applied in civilian cases of unidentified remains.

The identification of human remains in any mass disaster or war presents innumerable difficulties. In the American Civil War, almost half the reported fatalities remained forever unidentified. In World War II, however, the Memorial Division, Office of the Quartermaster General, established identification laboratories at various sites in Europe and the Pacific, employing physical anthro-

McKern-Stewart system for age identification (left) uses tiny portion of the human pubic bone —public symphysis—to establish skeletons' ages. Kit shows casts of pubic symphysis at various ages. Bone maturity can also be established by examining the femur (thigh-bone). Below are femurs at four stages of growth and development. Condition of the epiphyses—lobe-shaped formations at top of larger bones which are not present at birth but which develop later in life and become fused to the femur at maturity—aids physical anthropologists in determining age. Left to right: A, newborn, no epiphyses present; B, age 4, one epiphysis appears; C, age 12, both epiphyses present but unfused; D, age 20, both epiphyses fused. These two tests are used in combination with other information.

pologists to assist in classifying war dead remains. Ninety-six percent of the American fatalities were positively identified.

Operation Glory, initiated in 1953 following the Korean conflict, led to the accurate identification of 97.1 percent of American war dead. Dr. T. Dale Stewart, now curator of physical anthropology at Washington's Smithsonian Institution, established a Central Identification Laboratory at Kokura, Japan; here he worked not only to identify fatalities but also to collect photographs, casts and records of skeletal age changes in more than 400 individuals.

Later analysis of the Korean study enabled scientists to test existing identification techniques and to formulate new methods. From this analysis came the McKern-Stewart system for age identification from a tiny portion of the pubic bone. This system is now in use by law enforcement agencies all over the world.

Because teeth are the most durable of all body parts and because they differ greatly from one individual to another, they provide a means of identification second in value only to fingerprints. Police files are filled with murder cases where the missing element—the *corpus delicti*—was supplied by dentists working with anthropologists.

In one case, John Hamilton, a member of the famous Dillinger gang, was killed by gunfire while escaping from agents who sought to arrest him. His body, first treated with lye to avoid identification, was buried by his friends in an unmarked grave. The lye did its work—except on the teeth. Dental records from the penitentiary at Michigan City coincided exactly with teeth taken from the grave.

Perhaps the most thorough investigation ever attempted followed a Chicago furnace murder in 1956. Some 18,000 bone fragments were taken from the furnace and reconstructed to yield an identification sufficient to name the victim. In order to test his evaluation of the fragments, Dr. K r o g m a n—who was called in to testify—set up a test furnace and burned medical samples until he could predict the extent of damage by fire.

Little in the way of evidence is overlooked when verifying identification in criminal cases. Imprints made by bullets or knives constitute valuable evidence. Certain poisons—lead, arsenic, mercury and others—are recoverable from the bones long after death. Supplementary evidence—microscopic hairs found among bones—is carefully analyzed. Dr. Hamilton Smith of Glasgow University has demonstrated from a few surviving hairs of Napoleon that the emperor was given arsenic some 40 times between 1820 and 1821, the year of his death. On-going research—particularly race, blood and pathology tests—is conducted to enhance existing procedures, and it becomes increasingly obvious that the skeleton provides a rich source of medicolegal evidence. To misquote Shakespeare, "The evil that men do lives after them . . . oft interred with their bones." ■

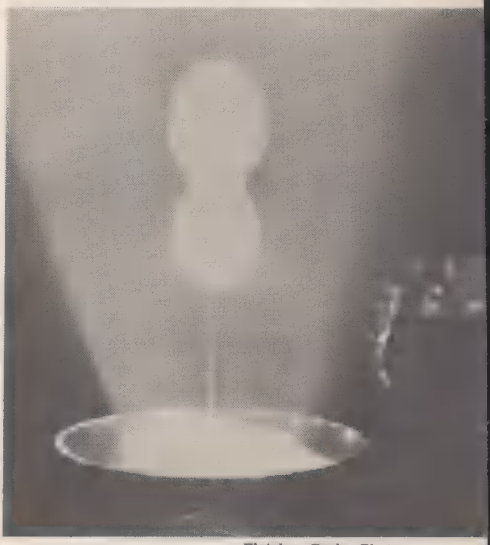
For further reading

THE HUMAN SKELETON IN FORENSIC MEDICINE. *Wilton Marion Krogman. Springfield, Ill. Charles C. Thomas. 1962.*

SYMPOSIUM ON MEDICOLEGAL PROBLEMS. *Samuel A. Levinson, Editor. J.B. Lippincott Co. 1949.*

NEWS IN BRIEF / Science Month

Balloons to fight tornados



Fletcher Drake Photo

Tornado experiments are being conducted by Dr. C. C. Chang, who hopes one day to use gas-filled balloons like this to destroy tornados.

TORNADO FUNNELS may be torn apart and destroyed with gas-filled balloons in the future, Catholic University of America scientist Dr. C. C. Chang told the American Geophysical Union recently. If he's right, you might see tiers of balloons anchored over cities and installations in the U.S. tornado belt, ready to be launched when a tornado begins to form.

Dr. Chang's studies, which have been carried out only in the laboratory so far, indicate that when gas-filled balloons are exploded inside a tornado-like funnel, the vacuum inside the funnel is broken for a fraction of a second. The two pieces fly in opposite directions. In his laboratory, Dr. Chang detonates the balloons with an electric spark that generates high pressure.

In an actual tornado, he theorizes, the top portion of the funnel would be collapsed by the explosion and shoot quickly away in a horizontal line for some 500 to 1,000 feet. The bottom part would collapse to the ground. The two-part collapse would last up to 20 seconds, giving the strong horizontal winds and violent turbulence that accompany the explosion time to complete the break-up.

Dr. Chang describes a tornado as an "integrated elastic appendage" hanging from a parent cloud and dragging along the ground. When the vacuum inside the funnel is broken, the top part of the funnel is

towed faster by the moving cloud while the bottom slows down because of ground drag. The disparity in speeds tears the funnel apart.

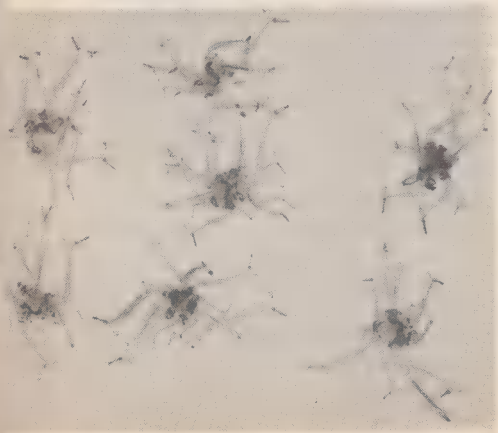
This summer, Dr. Chang and a Catholic University team will test his hypothesis in New Mexico with a milder form of funnel, dust-devils. Within a year or two, he hopes to be able to launch his balloons against actual tornados in full-scale field tests.

Other methods could be used to disrupt the vacuum within a tornado funnel, Dr. Chang says, but balloons are simple, safe and cheap.

Cleft palates and parents

Parents of the more than 5,000 children born each year in the U.S. with cleft palates or lips often need as much medical help as their children in adjusting to the situation, report a speech pathologist and a psychologist. Feelings of anxiety, guilt, ambivalence or even simple bewilderment can make the most well-intentioned parent almost helpless. Dr. Aaron H. Bleiberg, director of speech pathology at Mt. Sinai Hospital in New York, and Harry E. Leubling, a psychologist with the Department of Health, Education and Welfare, recommend a program of education to help parents function as an effective member of a team to treat their child's problem.

Dying mosquito larvae were trapped by glue-emitting weed seeds placed in water by U. of California at Riverside scientists, Eldon Reeves and Clemente Garcia, who are testing seed as new biological mosquito control. A pound of seed can kill 25 million larvae theoretically.



Why rhino lost its hair

Adult rhinoceroses have virtually no hair because (a) it wore off (b) older animals go bald or (c) it helps eliminate heat? According to *New Scientist*, the British publication, the third explanation is likely to be the correct one. Rhino skin is extremely thick but also an extremely efficient heat eliminator, discharging occasional copious amounts of sweat through large "apocrine" glands that are much like those in the human armpit. The absence of hair—it's there, but confined to the bottoms of the hair follicles—is a modification that helps in heat elimination. Rhinos also keep cool by walking slowly and lying in the shade during the day.

Aging cells make mistakes

Aging may be a matter of a cell's making too many "mistakes," experiments by Dr. Robert Holliday of London's National Institute for Medical Research seem to indicate. His work, which is described in a recent issue of *Nature*, supports a six-

year-old theory advanced by fellow Briton Dr. Leslie Orgel, now at the Salk Institute in California. Dr. Orgel proposed that aging in cells is a result of a cumulative buildup of chemical errors in important enzymes, particularly those that run the protein-production machinery (See "Aging—disease with a cure," Feb. 1969).

Dr. Holliday found that if he fed abnormal amino acid building blocks to a fungus called *Podospora anserina* to encourage mistakes in its enzyme synthesis, the tiny plants aged much faster than they ordinarily would. He also discovered that a mutant of another fungus, *Neurospora crassa*, makes an abnormal number of mistakes during its protein synthesis and dies sooner than the normal strain of fungi.

The same aging phenomenon might be applied to families of related cells—clones—in other organisms, including the amoeba and certain human cells, Dr. Holliday says.

Pass the powdered catsup

In 1984, you'll probably put powdered catsup on your hamburger, dehydrated fruit in your apple pie and concentrated wine—sherry, sauterne or Burgundy—in your wineglass. Your gelatin salad may be made with powdered fruit juice, and if you're on a diet you're likely to use a tiny bit of a sugar substitute that's 250 times as sweet as ordinary table sugar but tastes just like it. The high protein "meat" in your 'burger may not even come from a cow but from soybeans.

These food products, all on display recently at the Institute of Food Technologists' annual meeting in Chicago, are just a sample of the new items you'll be consuming 15 years from now, according to the institute. It's predicting that two-thirds of the food products we'll eat in 1984 haven't been invented yet and that in 15 years current cookbooks could well be collectors' items.

Peonies in the pavement—hardly seems possible, but here they are growing away in the black-topped parking lot beside City Hall and the firehouse in Cambridge, Md. Overambitious pavers covered the plants last summer. Then spring came, the pavement cracked and up popped the peonies. They stand 10 inches tall.

While most of these innovations will first be used by food processors and manufacturers, direct supply to the consumer will be the next step, says IFT. Some other new food products displayed: powdered mustard, dehydrated tomatoes, spun protein fibers, a corn syrup containing fructose and "flavor islands," jellylike spheres of flavor within an edible film for use in ice cream, frozen desserts and baked goods.

A conveyorized microwave oven demonstrated at the meeting is not designed for home, but its possibilities are exciting. It cooks by "molecular excitation" as foods pass through it. When hot dogs and ice

Wool tree made in A.D. 750 is part of a display, "Fabrics: Stone Age to Space Age," currently at Owens-Corning Fiberglas Center in New York. This example of early weaving is Peruvian. Antique looms, Egyptian galley ship with fabric sails, space suits also on exhibit.

cubes are run through, the molecules in the franks become excited and warm up the food but the ice molecules remain calm and come through without melting.

Yes, ball lightning exists

Some skeptics class ball lightning with flying saucers and ghosts, but a group of Westinghouse scientists who have been investigating the phenomenon take it more seriously. In a paper presented at a meeting of the American Geophysical Union, they suggest that ball lightning may be a mixture of extremely hot air and soot or other fine particles caused by ordinary lightning hitting a tree or other object. Ball lightning refers to the glowing grapefruit-sized globes that are sometimes seen drifting horizontally near the ground during thunderstorms. The orange glow emitted by the globes is about as bright as a 100-watt bulb and lasts about five seconds. According to Westinghouse, five out of every hundred persons have seen ball lightning.

Fiction-writing scientists

Some of the best-known scientists have written science fiction, a scientist reports in *The Chemist*. Dr. Morris Goran of Roosevelt University points out that Galileo's elegant style of writing may well have been developed by the literature he wrote as a youth and that Johannes Kepler presented his ideas about the moon and space travel in fictional form. In our time, W. Grey Walter, the British physiologist, has published *The Curve of the Snowflake* and B. F. Skinner, the psychologist, is known for *Walden II*. Astronomer Fred Hoyle has written novels, as has Sir Charles Percy Snow, who started out as a physicist and chemist. Jacob Bronowski, the mathematician, has written plays.

Dr. Goran doesn't mention *Science Digest* contributor Isaac Asimov, but the biochemist expects to publish his 100th book this year. He writes both fiction and non-fiction, usually on scientific subjects.

Cosmic rays and the moon

Samples from the moon's surface may reveal if the evolution of organisms on earth has been suddenly altered by cosmic rays from an exploding supernova, as some scientists believe (see "The Great Dinosaur Disaster," March 1969). Dr. Ray-

mond Gold of the Atomic Energy Commission told the American Physical Society recently that his method of examining radiation-produced tracks left in mineral specimens could be applied to minerals from the moon. By studying the tracks with an optical or electron microscope, he can tell the nature and magnitude of the bombarding radiation, the direction from which it came and the approximate time it took place. Using lunar samples, he explained, would eliminate the influence of the earth's atmosphere on organisms.

No more flat tires?

Bang! Bang! Bang! The movie policeman fires at the fleeing car, hits a tire, and the car veers off the road and crashes into a tree. The policeman grabs the gangster inside. It may not be so easy for the cops in future movies, though. Goodyear is working on a tire that won't go flat even when it's hit by bullets. The tire is filled with a rubber foam that expands under heat treatment to form a dense, spongelike substance that completely fills the tire casing. Engineers have fired bullets into foam-inflated tires, drilled holes into them, slashed them and driven them over spikes, but the tires roll merrily on. Foam inflation won't be practicable for passenger cars until engineers solve heat buildup and weight problems, says Goodyear, and the new tires will cost more than air-filled ones. But they'll be economical if you can't afford a puncture.

Puncture-proof, bullet-proof tires are new from Goodyear, though not on the market yet. Airless tire is filled with rubber foam that expands under heat to form dense, spongelike substance that completely fills tire casing.

Death from a broken heart?

Dying of a broken heart went out with dropped handkerchiefs and the fan—or did it? A British study reported in *Medical World News* reveals that the death rate among widowers 55 or over in the first six months after their wives had died is 40 percent higher than expected. Nearly half the widowers died of heart disease. The greatest difference between the widowers and men whose wives were living was an increase of 68 percent among widowers in deaths attributed to "coronary thrombosis and other arteriosclerotic and degenerative heart diseases." Widowers also showed an increase of 60 percent in deaths due to other heart diseases. The explanation may lie in emotional stress that effects changes in pulse rate, arterial blood pressure, cardiac output and other functions, says the British team that made the study.

Population explosion: a warning from the insects

Starvation, war and other forms of mass death may be in store for mankind if the population explosion continues as it is.

by Jeanne Reinert

CROWDED ELEVATORS, crowded sidewalks, stalled traffic and double-session classrooms—we are bombarded with the effects of a population explosion. In 6000 B.C., we humans numbered about five million individuals. In 1,000 years, we doubled. We doubled again in 200 years, then in 80 years. Doubling time now is about 35 years. In other words, there are more and more people in less and less time. Given this knowledge, is there a way to predict what will happen? What could stop or slow this growth?

One way to find answers is to compare data with other kinds of populations that have grown rapidly. Comparisons with other animals are not satisfactory. If dogs live 10 years typically, it would take 100 years to get results for 10 genera-

Natural predators like this praying mantis, shown consuming a grasshopper, control part of the world's booming insect population.

Photos courtesy Canada Department of Agriculture

tions. Insects, however, live very short lives. Multiple generations can be studied in a fairly short period. If diamond-back moths produce two generations per season, then only five years are needed to study 10 generations. Clearly, insect studies could give us insights into population explosions.

Drs. D. G. Harcourt and E. J. LeRoux, ecologists with Canada's Department of Agriculture, have made such studies. They now predict that "The world's population explosion cannot and will not continue." Dr. Harcourt adds, however, that the process of leveling off "may not be entirely pleasant." He has found that various key factors come into force when insect populations explode. The same type of key factors seem to be emerging to control our human population explosion.

Insects have been on earth for 400 million years. Today, says Dr. Harcourt, their populations are finely attuned so their essential needs are not overrun by too many of them. When the insects outnumber the resources, various factors reduce the number of insects. When the resources are more abundant than the insects, the latter multiply. The further the insect numbers rise or fall, the stronger is the tendency to return to the previous population level.

For 10 years, Drs. Harcourt and LeRoux studied Canadian insect pests, many in their natural habitat, to find out what caused the populations to flourish or diminish. The life tables the researchers compiled showed that for most species, random chance or a combination of causes did not create the variations. Instead, they found that a single "key factor" controlled each species.

This key factor is usually bound up in the raw numbers of the population. The key factors "act more severely against the population when the density of the insect is high and less severely when the density is low," explains Dr. Harcourt in *The American Scientist*.

The two scientists took their insect studies and found patterns in the causes of life and death. With these patterns as models, they could set up predictions on population trends. With data from several generations of insects, they found that typically there is a single critical stage for each species. At this time, the insect is vulnerable to key factors. What happens at this stage determines the population trend.

Armed with 12 definitive insect studies, the researchers drew parallels with man's population trends.

These cabbageworms (top) are responsible for great damage to the yearly cabbage crop. Overpopulation of worm is serious problem. Parasitism helps control populations. Smaller black fly pupa lives off host cabbageworm (above) and decreases the worm population.

Here is what they found: Key factors for insect regulation are natural enemies, migration, weather, food supply and disease. Potential key factors are vigor, fecundity, social behavior and stress. For man, the researchers defined potential key factors as fertility, disease and accidents, stress, migration, food supply and war.

The biggest single control on insects is natural enemies. Insectivores such as moles, shrews and hedgehogs are typical enemies of insects. Also, other insects such as beetles, praying mantises and certain larvae are natural parasites or predators of insects. Parasites or predators regulated the size of six of the 12 species studied. In these instances, the more the insects flourished, the greater grew the enemy's numbers. Thus, when an abundance of winter moths exists, their enemy, having a big food supply, generally increases in proportion to the winter moth population. This cycle is a wavelike pattern, the enemy's numbers following hard on the heels of the winter moth population explosion.

So far, armed with his technology, mankind today is seldom threatened by natural enemies.

Migration regulated the size of three of the 12 insect species. When a group of insects outgrows the food supply, migrating insects take off to look for other suitable areas. If necessary food supplies are not found, then members of the migrating crew starve to death.

In insects, migration has some fascinating mechanisms. I. M. Campbell found that insects that feed on foliage bring about their own problems. As the insects eat and eat, their food supply grows smaller and smaller. When the insect is very young and its skeleton is growing, it is the most likely to find food. As each larva grows older, it is less and less likely to find food. It is in the final stage of growth that most of the reproductive material is laid down in the insect body; at this time, the insect is least likely to find food. As a result, when the fruit-tree leaf roller is rampant, there is little food and hence, its egg load is smaller than the actual capacity of the female. "This results in a reduced egg load which not only increases the ability of females to fly, but also the distance that they can travel," explains Dr. Harcourt.

If there is only a limited number of fruit-tree leaf rollers, the females develop lots of eggs and become heavy. They are grounded just like overloaded airplanes and stay in the same area to lay their eggs. On the other hand, if many insects cause a limited foliage supply, then the females have fewer eggs and are able

to fly into another area before laying eggs. Thus, the foliage-feeding insects have a built-in control that favors migration when the population outstrips food. Migration allows the insect population to adjust in advance to the habitat.

Just as insects move when crowding occurs, so man migrates to find a better home. Emigration has always been a safety valve in countries such as Britain and France. Surplus people moved to these countries' colonies. Irelanders moved to the U. S. during the great Potato Famine in 1846. Today, however, immigration laws refuse these exoduses. Strict laws forbid people from entering the wealthier countries such as the U. S.

As the crowding grows, border conflicts turn into explosive political contests. War is an attempt of one people to better their lot at the expense of another.

Weather is also a key factor in the life of an insect. Each is specialized to fit into a particular climate. When several good seasons follow one another, an insect will spread to areas where the weather is sometimes hostile to it. When the weather reverts to its typical harshness, insects living in the fringe areas are wiped out.

As another example, the diamond-back moth lives all year round in South Africa where the weather is seldom severe. There, the size of the population is controlled throughout the year by enemies that thrive when the population is dense. In contrast, the diamond-back moth only survives during the spring and summer in Eastern Canada. There, the time of the flight period is the critical stage. Survival depends on fair weather during the flight.

Closely tied to weather for both man and insect is the food supply. For some insects such as the Colorado potato beetle, natural enemies are few. The food supply or lack of it governs how many offspring grow into adults. When the food supply is gone, the larvae simply starve.

The spectre of famine lurks over large segments of the human population already. Presently, about one out of every 1,000 people goes to bed hungry at night. Chronic malnutrition is suffered today in many countries. However, rich countries today export extra crops to poor nations. Worldwide estimates suggest that three to four million persons per year die directly or indirectly from starvation. With the prospect of a rising population during the next decade, experts do not expect the crops to keep pace with the extra hungry mouths. As with the insects, too little food affects the young most. Studies last year showed that, deprived of needed foods in early years, an individual has reduced intelligence for the rest of his life.

Disease is another key factor for insect mortality. Infectious diseases, spread over forest and field by bacteria, fungi and protozoa, kill whole populations of insects. The thicker the population, the more easily the disease is spread.

In man, deaths from infectious diseases plummeted between 1930 and 1950. Childhood killers such as polio, smallpox and diphtheria have become just names of diseases of the past that nobody gets anymore. Since the 1950s, mortality from infection has leveled off, but flu outbreaks occasionally cause fluctuations in the death rate from infection. Most deaths now in the wealthier countries are caused by cardio-

vascular disease and cancer.

Natural enemies, migration, weather, food supply and disease—these are sure thing regulators for the insect world. There are other factors—vigor, fecundity, social behavior and stress—more subtle, but also effective in reducing the size of insect swarms.

How does vigor threaten a population? Insects such as the Western tent caterpillar thrive in British Columbia. In adulthood, the stronger moths migrate. Weaker moths, unable to fly long distances, remain near their birthplace. These inferior insects breed with other inferiors and produce successive colonies that are more and more sluggish. Soon the sluggish colonies outnumber the stronger ones. Suddenly, so many insects vying for the same food supply mean a sharp decrease in food. The first season of bad weather wipes out the weak colonies. Those of average vigor die too, as there are not enough of them left to provide the silk and the mass of warm, insulating bodies needed to survive in the harsh season. With only strong colonies surviving, another round of population growth begins.

Some insects have a tremendous capacity to reproduce. They are able to lay hundreds of eggs per female. The maximum capacity is the insect's fecundity. Adverse conditions may force each female to lay a lesser number of eggs. Spruce budworm larvae reflect this control. They eat only tender young shoots of the host tree. A lot of larvae result in all the young tree shoots being consumed before the insects are adult. The young and tender foliage gives out about the same time as the next generation is developed in the larvae. Underfed females lay fewer spruce budworm eggs. Thus, the next generation of insects is less numerous than it could be. The population density causes a decrease in fecundity.

Egg-eating, killing one another or throwing out the weaker members of the colony are methods of handling overcrowding adopted by termites, wasps, bees and ants. Some changes in social insects depend entirely on crowding. In locusts, for example, if individuals are widely separated, each one lives a rather solitary life. However, this can change. Repeated meetings with other locusts result in their learning to cluster. The infants or nymphs from these newly gregarious locusts are more excitable and active than the nymphs born to solitary locusts. Additionally, these nymphs develop more flightworthy wings than do the solitary nymphs. When the locale gets overcrowded, the locusts gather more and more frequently; ever-enlarging swarms occur. Finally, the whole swarm takes off in a long migratory flight. The few locusts left in the homeplace then revert to the solitary life.

If insect analogies hold with humans, stress can cause real problems. Perhaps those headaches, tensions and upset stomachs are brought on by overcrowding. Certainly, cabbage looper larvae develop stress problems. They die from it, indirectly. Here's how that works. The larvae are aggressive and fight over preferred feeding spaces. When larvae were crowded in laboratory studies, the competition grew keen. Then the larvae ate less, more sporadically and used their energy to compete. These stresses appear to cause chemical changes in their bodies. The in-

Tomato worm population is controlled partly by parasitism of braconid pupae shown attached and feeding on the destructive worm.

Overcrowding such as these pine sawfly larvae show is generally controlled in nature by some natural disaster, starvation or predation.

sects became more susceptible to disease. Larvae often died from infections that are normally nonfatal to cabbage loopers.

V. C. Wynne-Edwards observed in 1965 that this type of stress also affects mammals. Social rivalry depends on the population density. The keen competition causes stress. In higher mammals, stress can cause changes in the mating act. One example is an increase in homosexuality. This may also be true of man.

The period of fertility is also a factor. As more food and better hygiene brought up the standard of living in the Western world during the century from 1850 to 1950, the period of fertility in women increased about a decade. However, World War II studies show that the strain of being in a war-torn country reduces the period of fertility by the same time, that is, a decade. It is not the war itself that reduces fertility, but the emotional excitement. This stress might become a factor when the human population grows too crowded.

With their insect studies reduced to quantitative effects, Drs. Harcourt and LeRoux can discern key factor trends and measure the rates. If similar key factors can be identified for mankind, then trends can be discerned and their size forecast. Then we may understand what controls or key factors are working in containing the population explosion.

Given how grim the potential key factors are—increasing stress, explosive political situations, starvation and atomic warfare—the researchers hope they will be avoided. The other potential key factor is increasing affluence, which seems to go hand in hand with declining birth rates, but affluence looks improbable in the crowded, poor countries. What alternatives are there? The two ecologists propose the best alternative at this time is family limitation.

Based on his study, Dr. Harcourt warns, "It is apparent that man's present rate of population growth cannot be sustained. Just as insect populations, in the course of evolution, have come into equilibrium with their environment, man must reach similar reconciliation with his resources." ■

For further reading

FAMINE ON THE WIND. *G.L. Carefoot and E.R. Sprott. Rand McNally. 1967.*

THE POPULATION BOMB. *Dr. Paul R. Ehrlich. Ballantine Books. 1968.*

THE SILENT EXPLOSIONS. *Philip Appleman. Beacon Press. 1965.*

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Giant Saturn photographed at Palomar Observatory

Head of a fruit fly magnified 180 times

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WSD9H1

Only trees and tortoises live longer than people

Man lives to a riper old age than he generally thinks. The only real Methuselahs today are trees and certain tortoises.

by David Gunston

HOW LONG DO WILD THINGS LIVE? Is man's normal life span puny by comparison with many of them? Like many other fascinating aspects of nature, the records of animals' life spans have been greatly exaggerated. Genuine Methuselahs are just as rare in nature as they are among human beings.

In fact, only trees live vastly longer than men, and from the animal kingdom only the giant tortoises of the Galapagos and Seychelle Islands regularly live beyond the human limit.

Elephants only occasionally outlive men, but very few other creatures achieve such a feat under normal conditions.

If you check the facts, you'll find that man has always tended to overdo nature's powers of granting long life to her creatures. Once he realized that some things do occasionally outlive him, he fell for every exaggeration that was thought up by quack sages from the 6,000 years that every churchyard yew tree is supposed to live to the phoenix which "lyveth 300 or 500 years, when which years have passed she maketh a neste."

It's strange that trees should have such a hold on life, especially since the shortest lives in all nature are also from the vegetable kingdom: many flowers of cacti live for just a few hours, and the flowers of wheat live for two hours at the most.

The claim for the oldest tree in the world comes from Queensland, Australia, where a macrozania tree is reputed to be at least 12,000 years old, although it is still only 20 feet high.

For some reason, people seem to enjoy believing in legends of extreme longevity where trees are concerned —lack of proof is often merely ignored. The famous dragon trees of Orotava, in the Canary Islands, most of which have now been destroyed, were widely held to be anything from 8,000 to 10,000 years old, perhaps with some vague justification, although no reliable ring counts were ever made to prove this.

Probably the record for the genuinely oldest tree alive today is held by the gigantic Tule cypress growing in a spacious churchyard in the village of Santa Maria de Tule, near Oaxaca, in Southern Mexico.

In vigorous health, this spreading, weeping tree has a trunk diameter of 52 feet, which means that 28 people

touching finger-tips can barely encircle it with ease. Yet it is only about 150 feet high, and is easily towered over by many ancient Californian sequoias, or redwoods, for which extravagant claims are also made. But the average girth of a sequoia 3,000 to 4,000 years old is seldom much above 36 feet.

The history of the Tule cypress is lost in the mists of Mexican time, but it is undoubtedly every day of 5,000 years old. The oldest proved age for a giant sequoia, based on a careful ring count, is 4,000, and many still growing are over 3,000 years old. Indeed, a 1,000-year-old sequoia is still a youngster.

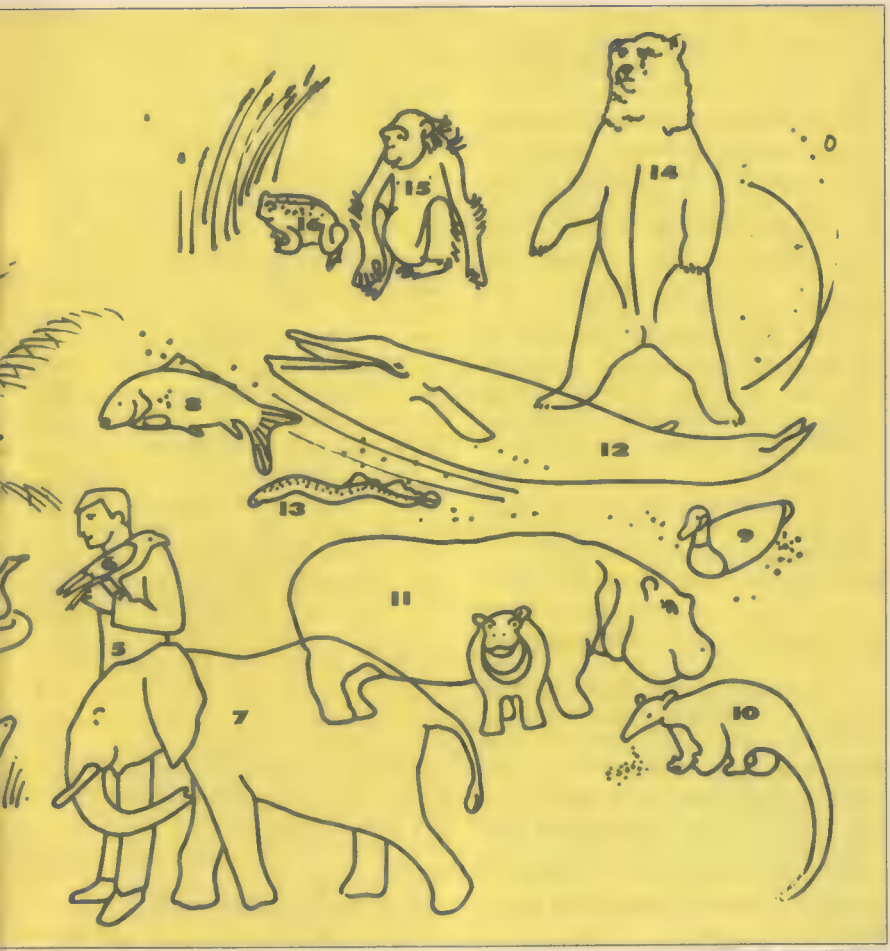
Even so, it's a staggering fact that any living organism which was contemporary with the Bronze Age and the Ancient Egyptian and Mesopotamian civilizations, and which was over 3,000 years old at the birth of Christ, should still be thriving today. It is deserving of more respect than that given it by some tourists with their initial-carving penknives.

Churchyard yews are often over 1,000 years old, but apart from their known powers of longevity, only the English oak can stand up to serious investigation as commonly living for 500 years or more. Beech trees rarely exceed 400 years, and the normal life span of most trees of this kind is not more than 250-300 years. Many others die before they reach 150.

Frequently the known dates of alien trees imported into other countries disprove false claims of old age. For instance, it is commonly held that Francis Bacon planted the catalpa tree in Grey's Inn, London, but this species was not introduced from America until 1726, when Bacon had been dead exactly a century.

The Galapagos and Seychelle tortoises are the only real Methuselahs of the animal world, attaining a span of up to 200 years on occasion, regularly 100-150. One famous Marion's tortoise lived in the army barracks at Mauritius, an island off the Indian Ocean coast of Africa, from 1766 until 1918, when it was killed

(Continued on page 50)



Drawing: Ellen Williams

Longevity Chart

1. Macrozania tree—12,000 years
2. Galapagos tortoise—100 to 150 years
3. Mute swan—170 years
4. Parrot—140 years
5. Man—70 to 100 + years
6. Raven—69 years
7. Elephant—65 years
8. Carp—47 years
9. Goose—44 years
10. Anteater—42 years
11. Hippopotamus—41 years
12. Whale—37 years
13. Eel—36 years
14. Bear—34 years
15. Chimpanzee—26 years
16. Toad—15 years

accidentally at the age of 152. Captain Cook's famous tortoise lived on the Island of Tonga in the South Pacific from 1777 until its death in 1966, and it was probably already several years old when the British explorer gave it to the island's king.

Mediterranean tortoises live long, too, and one has been reliably recorded as dying when 125, while the little box turtle has been known to reach 123 on rare occasions.

Of all the mammals, from mice to whales, only the elephant occasionally outlives man, although many specimens enjoy the traditional human span or less. According to the records of the Bombay-Burmah Trading Company, of their 17,000 working elephants, only about 9 percent live to between 55 and 65, and less than 2 percent beyond 65.

Elephant lives to ripe age

Quite a number of elephants over 50 years of age have been known in captivity, and one in a U.S. zoo was alleged to be 85 when it died, and another 70. It's rare when one reaches a full century, and the stories about zoo elephants having carried several generations of children on their backs are just a little exaggerated.

The original "Jumbo" of the London Zoo, whose popularity started such tales, died from an accident when only 24. Nevertheless, a few of the old bulls in wild elephant herds have probably lived for longer than the average man.

The domestic horse, if allowed to survive into senility, probably lives next longest among the mammals, and several cases of 50-year-old horses are on record—and one exceptional case of 62. Even so, a horse living to 47, as one in England did recently, attracts a good deal of attention. Most horse-owners have their animals destroyed long before that.

One donkey has been known to live to 47, and in various zoos, a hippopotamus of 41, a rhinoceros of 40, several bears from 30 to 34, a spiny anteater of 42 and a chimpanzee of 26 are all authenticated instances of comparative longevity.

The oldest dog whose claim seems allowable was 34, but one of over 20 is exceptional, and 18 a remarkably good age for the average pet.

Cats, however, do live surprisingly long, and specimens known to be 39, 31 and 27 are recorded and many over 20 are known. The longest reliably accurate span for a whale is 37 years, but it is generally thought that the larger whales normally reach 30 or over—if the whalers let them.

At the other end of the size scale, insects have notoriously short lives, although a tapeworm was once reported to have lived inside a man for 35 years. (This smacks a little of legend, but numerous persons swear that it's true.)

In all these cases, the life spans of creatures kept in captivity are longer than they would be for wild animals. The hazards of nature are such that real old age is comparatively rare and is achieved only by fluke or good fortune. Loss of vigor, failing eyesight and above all, deteriorating teeth, take their swift toll in the wild, leaving only a tiny proportion of the original population to enjoy a lengthy span.

In a cage things are different: food is always plentiful without the

The smaller and more prolific the creature, the shorter its life expectancy seems to be.

need for hunting, there is permanent shelter and freedom from enemies. Even accidents are seldom met with.

A 25-year-old fox in captivity is really abnormal. It's lucky if it manages to live to the age of 14 or 15 in the wild—with broken teeth, scarred muzzle and grizzled emaciated body.

There is a good record of a wild tiger of 17, but among the smaller hunters the weasel is decrepit at only 8. Badgers may live to be 16 or so, and they are closely followed, surprisingly enough, by toads, which live much longer than frogs.

Generally speaking, the smaller and more prolific the creature, the shorter its average expectation of life. There is undoubtedly some link between physical size, low reproductive powers and longevity.

The oldest known bird is always said to be the mute swan shot in Derbyshire, England, in 1887 bearing a ring on one leg dated either 1717 or 1711, which seems to indicate that it was at least 170 years old at the time of its death.

An eagle shot in France in 1845 was found to be wearing a metal collar with a Latin inscription indicating that the bird had been used for falconry in the Caucasus in 1750, over 90 years before.

Both these cases, if true, are quite exceptional. The raven is probably the most common bird Methuselah: records to 69 are known. Others surviving for over half a century include pelicans and condors, 52; eagle-owl, 68; golden eagle, 56.

Among captive birds, the parrots achieve the greatest age; 140 is about the record here. But a number of parrots have lived well over a century, including one of 125. Cockatoos also enjoy long life, once in a while reaching their 90s without loss of perkiness, although baldness and loss of memory are usual.

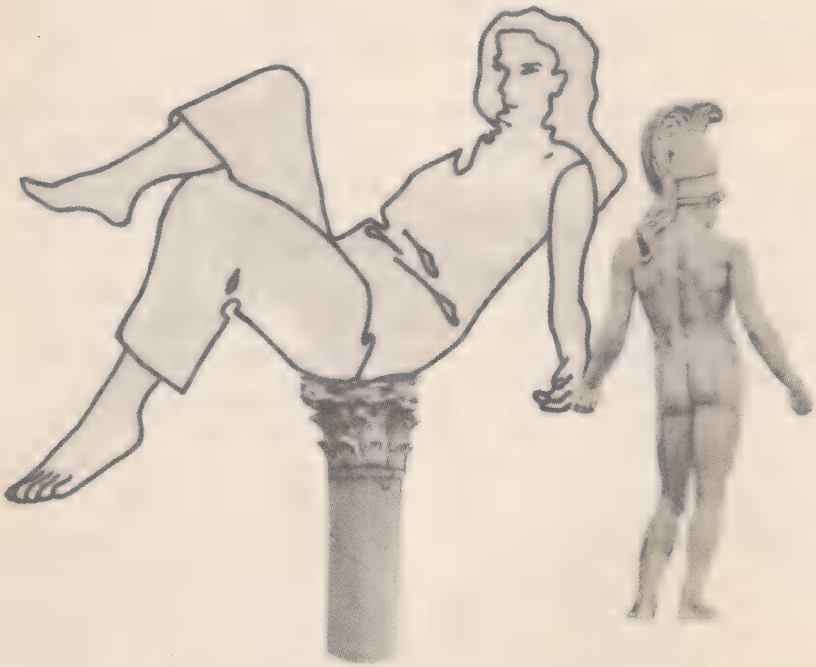
Really old age among truly wild birds is difficult to prove, but is undoubtedly rare. A magpie at 30, an Arctic skua at 25, a chaffinch at 17 and several ducks at 14 are all probably maximum ages.

Man better than most

Indeed, to reach 10 is a feat for most small birds, and larger birds of 20 or so are quite uncommon. Captive geese live much longer than their wild brethren: one in England was 44 when it died, and records of 33 and 37 have been proved accurate.

I also know of a pet canary in England aged 23, although an American bird is said to be 32 and still singing. An eel of 36 and a mirror carp of 47 lead the known fish longlivers, but although cases are known of a goldfish of 30 and a flounder of 25, most of the larger fish seldom reach their 20th birthday, and nearly all the smaller species die before they are 10 or 12. Aquarium keepers often swear that they are lucky if their tropical fish live more than just a couple of years.

All in all, man with his threescore years and ten fares better than most of his fellow creatures. Only the silent, immutable trees make him look like a mere baby. ■



Drawing: Ellen Williams

Your body image: what it tells about you

by Richard M. Kurtz

THE HUMAN BODY has been an object of study ever since the time of Hippocrates. Many investigators, for example, have suggested that there are connections between a person's body shape and his temperament and behavior. Thus people who tend to be fat were supposed to be phlegmatic; middle-girthed, muscular mesomorphs were supposed to be inclined toward extroversion, and to make up the majority of criminals.

But what impression do we get of our *own* bodies, and how does this affect our self-images, our feelings of worth and virility, our happiness and our behavior? In spite of the psychological importance of the answers to such questions, very few people have ever done research in this area.

Now it seems reasonable to postulate that a person is concerned, often absorbed, with these impressions and attitudes about the appearance of his

Richard Kurtz is assistant professor of clinical psychology of Washington University.

body. It also seems reasonable that he would judge these impressions along three major dimensions:

First, *value*. Is his body, as he sees it, a "good" or "bad" kind of body? *How* good or bad?

Second, *potency*. Would he consider it strong or weak, and *how* strong or weak?

Third, *activity*. Does he look upon himself, and his body build, as essentially an active or passive kind of body, and *how* active or passive?

These questions were put to my subjects—89 men and 80 women, all young, white college students, and most of them middle class. Using a seven-point scale, they were asked to rate themselves on 30 different body concepts, such as "size of my arms" and "color of my hair." The results were broken down according to sex, general size of the subject (large, medium, small), the subject's general build (leptomorph—thin and narrow; mesomorph—medium muscular; eurymorph—wide and squat).

From my findings it seems plain that people—especially women—do have general, global attitudes toward their body builds, and that they do have opinions about whether their bodies are good or bad, strong or weak, active or passive.

As is evident to almost everybody, men and women are built differently, and are aware of the difference—although there is some overlap, especially these days. Women especially are aware of their distinguishing characteristics, and in considerably greater detail than men.

A person's attitudes and expectations about his body are, as a matter of fact, closely related to his sex. Our society seems far more conscious and more admiring of the female form than of the male.

A great awareness about one's bodily appearance is obviously more acceptable in women than men—a finding supported by common observation. It is part of being a woman in our society to try to be "attractive"—to focus attention on the parts of the body that are well-proportioned and sexually stimulating. Men are not supposed to take such an obvious and active interest in their bodily appearances.

It seems logical, then, to hypothesize that a woman has a more clearly differentiated body concept than a man—that women draw finer distinctions between the qualities of parts of their figures than men do about theirs. This hypothesis turned out to be true. Consistent with this, women tend to value their bodies more than men do; they tend to show more approval of what their full-length mirrors tell them.

This finding clearly contradicts the psychoanalytic theory that women have a lower evaluation of their bodies than men because of "penis envy." The women in this study, whatever their secret and suppressed feelings might be, indicated they had a *higher* evaluation of their bodies.

On the other hand, since muscular strength, aggression and dominance are considered desirable, masculine characteristics, men should rate their bodies higher in potency than women do—and this was confirmed.

Among men the large mesomorphs—being not fat or thin, and inclined towards muscle—liked their own bodies better than all other male types did. They also thought them-

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selves the most active. This fits in with our conventional idea of the he-man. But this picture, especially for potency, was not consistent down the line. Thus, large mesomorphs and small mesomorphs thought their bodies more potent than did any of the varieties of thin men (leptomorphs). But so did the large and medium euryomorphs, the squat men —more so, in fact, than the medium mesomorphs did! These findings are tentative and seem a little confused. But what they may indicate is that men not only associate potency with physical strength, but also with bulk.

Broad hips and potency

Among women, the large, thin leptomorphs liked their bodies more than all other types liked theirs. The eurymorphs—usually broad-hipped, big-breasted—generally saw their bodies as more potent. Again, whether this self-evaluation came from an association of bulk with strength, or whether "potency" was considered symbolic of sexual or reproductive capacity in women, must be left for a future study. But however potent the fat women were, the thin women considered themselves most desirable, an opinion generally shared in our nation.

Several investigators have shown that college and non-college men and women tend to look down upon the thin and the stout in favor of the mesomorphs, to attribute more undesirable personality attributes to people with extreme body builds. In people's stereotypes, the skinny are usually pinched and mean, and the fat are usually gluttonous, unattractive and insensitive. Do leptomorphs and eurymorphs themselves consider their body builds less desirable? The men do; but the women do not.

Investigators seem to agree that the eurymorph—being broad and usually overweight—is basically more passive, calm and lethargic. His opposite number—the thin, narrow leptomorph—is often characterized as active, excitable and tense, with a faster reaction time. Logically, I expected the leptomorphs to judge themselves as more active than the eurymorphs. But this was not true—for either sex.

Now, in American society it is apparent that height is related to how people feel about their bodies. Consider the demand of small men for shoes that will increase their height. In our culture, height in men, among other physical characteristics, is associated with dominance, self-confidence and leadership. And a large body size is seen by many as reflecting an image of dominance and strength. People of large body size are assumed to be more powerful than small people.

Generally, this hypothesis checked out. But there were distinct and significant sexual variations. Tall, thin men put the lowest values on their bodies; tall, thin females the *highest*. And though the large, male mesomorphs had the greatest belief in the potency of their body build, with women it was the large, fat eurymorphs who did.

Instead of discussing all the results of this study, however, I would rather discuss what is missed—to indicate future directions for research.

No straightforward attitude measure can begin to reveal the complexity and richness of the feelings—conscious and unconscious—that people have about their bodies. One

American society demands that a man be tall or large to be authoritative and domineering.

sure way to lose the personal and individual is to analyze central tendencies between *groups*, as has been done in this study. Perhaps we can restore some richness through depth interviews, or projective techniques.

And what of a person's attitudes and fantasies about the *inside* of his body, and its products? How does this affect his overall view of what he, and his body, are?

It is also clear that the body dimensions used in this study are not the last word in precision. Might not the actual amount of fat, and its distribution, have more meaning for a person's attitude toward his body than simply the designation of "leptomorph" or "eurymorph?" Further, white college students 18 to 23 years old are obviously not a representative population. In this group there was little significant difference in the findings because of the age spread —but middle-aged and poor people almost certainly regard their bodies differently.

Perhaps to some extent we all live in the past. Do middle-aged people tend to see themselves as straighter, thinner and less gray—as they were in earlier days and in old photographs? Paul Schilder has speculated that the rapid physical changes during puberty and adolescence may result in a body-concept lag, with the changing body outstripping the mind's grasp of it. Puberty usually does disturb a teen-ager's attitudes and impressions. Anna Freud has reported that many adolescents develop a sharp increase in puritanical and ascetic attitudes toward their bodies—perhaps indicating a lack of acceptance of the changes, and perhaps also indicating a lower evaluation of their bodies. But this was not explored in my study.

And what of race? Do blacks have the same attitudes toward their bodies as whites have? Do many really think that black is beautiful, or have they—as Erik Erikson believes—internalized white standards to the extent of downgrading their own distinctive bodily traits? (A recent survey found that whites often consider blacks "bad," "potent" and "passive.")

Body image effects

To what extent do a person's body attitudes affect—or become associated with—his other concepts about himself? Does the large, male mesomorph also tend to regard himself as superior in intellect, athletics, creative ability—to consider himself Abraham Maslow's all-round superior being?

This study, unfortunately, has not been able to answer these questions. It *has* demonstrated that people do have total body impressions that have important consequences. It has shown that, for the population tested, there are meaningful and often complex relationships between these attitudes and sex, body size and body build. And perhaps it has also shown that down this path of discovery—relating how people see their bodies with how they see themselves—may lie some field of understanding not yet explored. ■

The realities of changing sex

by Arthur J. Snider

MALES who insist on change-of-sex surgery should first undergo a trial period of treatment with female sex hormones and experience a feminine feeling to determine if they can make a satisfactory adjustment, in the opinion of a University of California physician.

Dr. Richard Green, director of the Gender Identity Research and Treatment Clinic, pointed out that feminization with female hormones is reversible, thus giving the patient more time to consider his decision before it becomes irrevocable.

Some seeking sex change have led a lonely life and think they will have a rebirth with a blissful, exciting and romance-filled life in which they will meet the man of their dreams, Dr. Green notes, adding: "Unrealistic expectations can only lead to disappointment. Tempering should take place prior to surgery."

A male patient must be able to pass as a socially acceptable woman in appearance without arousing undue suspicion, Dr. Green points out. His beard must be removed over a year's time by electrolysis, which costs more than $1,000. Thick makeup will not cover it satisfactorily.

Time also is required to obtain civilian documents for everyday living, such as a driver's license and a Social Security card.

The ability to work and support one's self is also required. The patient may not be prepared for a job as secretary, clerk, saleswoman, beautician or waitress and the abrupt change from the salary of a professional man to the salary of an unskilled woman can pose another adjustment problem.

Cigarettes cause lung cancer

How cigarettes—one's "personal air pollution"—impair the lung's defensive platoon and open the door to cancer, emphysema and bronchitis is shown by a Burlington, Vt., scientist.

Dr. Gareth M. Greene, director of the respiratory diseases unit of the University of Vermont Medical School, says some yet unknown factor in tobacco smoke damages those cells in the lungs that serve as "garbage collectors."

Known as phagocytes, those cells swallow and destroy foreign matter. But their activity is depressed, says Greene, by something in the cigarette gases. This gives harmful bacteria and other foreign agents a chance to multiply in the lung's air sacs, and over the long term to promote lung disease.

Some 250 possibly harmful agents are to be found in cigarette smoke. These are now under study to determine which may be guilty.

Surprisingly, he said, the offending agent is not to be found in tar or nicotine. Thus, filters that screen tar and nicotine have no effect in reducing the toxic agent, according to Dr. Greene. In fact, he says, tar and

nicotine may be helpful in reducing the toxic substance by absorbing a portion of it.

The findings have been worked out on animals. They show that only a small amount of tobacco smoke can be damaging if it reaches the depths of the lung.

He believes that cigarettes are more damaging than genetic factors, childhood illnesses, virus infection, occupational factors, such as dust and fume inhalation and allergy factors, such as pollens, in reducing the number of phagocytes.

Replacing bones with pottery

The possibility of using a new bone substitute—ceramic—to replace bones and joints and provide implanted teeth is held out by a development at the Ohio State University College of Engineering.

Orthopedic physicians and oral surgeons are testing the pure white porous material as a prostheses in animals. Trials on monkeys by Dr. Edward J. Eyring of the Children's Hospital, Columbus, show the material is inert and does not provoke a rejection reaction.

Most artificial joints now used to replace natural joints make no attempt to duplicate the natural bone structure, Dr. Eyring points out. They are simply mechanical devices of metal and metal-and-plastic. But the new ceramic process appears to have opened the way for artificial joints that have more natural joint action.

Dr. Morgan L. Allison of the Ohio State College of Dentistry believes that ceramic substitutes for teeth and jaw bone are likely. For use in the mouth, the ceramic would replace the roots of teeth and a small peg on top would be used to hold a porcelain cap similar to those now used to cap natural teeth.

Ceramic is a general term covering everything from clay bricks to fine porcelain. It is derived from potter's clay, or pottery, and is widely found in nature.

A new way to process the ceramic was developed by William B. Campbell of the department of ceramic engineering, Ohio State. It permits forming the material into a variety of shapes. The secret is the porosity of the material.

Campbell, who at one time planned to become a physician, has a personal interest in development of a successful bone replacement material. Since his teen years he has carried three stainless steel pins in one hip and walks with a slight limp.

How pot-smokers start

An in-depth survey of drug use on two college campuses shows that although marijuana smokers tended to

cite intellectual goals as their reason for pot, they were less likely than non-smokers to be near the top of the class.

Half the marijuana smokers ex-

pressed dissatisfaction with school in contrast to 20 percent of the nonsmokers. Most smokers found attending class regularly too much of a burden. There was a higher incidence of divorce or parental separation in the families of marijuana users, Dr. Edwin S. Robbins of New York University reports.

The two schools, both in the New York area, were shown in the survey to have only a minority of their students involved with illicit drugs. Many of the others, however, used other forms of drugs. A tabulation revealed 39 different substances, ranging from aspirin and laxatives to tranquilizers and amphetamines.

Among the non-marijuana users, amphetamines were the most popular drug. Loneliness and tension were given as the most frequent reason for use.

"During the last year of high school, a small number of students began to take non-prescription stimulants or sedatives in order to study more effectively. After starting college, they tended to shift to more potent medicines."

Marijuana was typically smoked for the first time during college.

Nuns and breast cancer

The health histories of 116,536 nuns are being followed to see if creating an artificial menopause would reduce the toll of breast cancer in American women.

Dr. James T. Nix of New Orleans reports that the rate of cancer of the breast in nuns after age 65 is twice as high as that for American females in general.

It is also known, he says, that the menstruation period in nuns extends for a longer period than in the general population.

The question to be answered, says Dr. Nix, is whether continued activity of the ovaries in secreting female hormones increases a woman's cancer hazard, and if so, whether an artificial menopause by hysterectomy might be advisable for women somewhat earlier than natural events bring it about.

The study is considered to be of value because the test subjects make up a controlled group of known size and occupation whose environment is made up of communal living, celibacy, abstinence from regular use of tobacco and alcohol, a well-balanced diet and good housing.

These conditions eliminate a number of variables and make factors that promote illness more easily identifiable.

With convent rules becoming eased through ecumenism, it is essential that the study be completed now, says Dr. Nix. Such an opportunity to underscore factors responsible for cancer may never come again.

Dr. Nix says that up to age 65,

the mortality rate for all causes among nuns is about half that of women in general.

After that age, the mortality rates are similar, except for breast cancer.

Another discovery is that when breast cancer does occur in nuns, the tumor grows much more slowly.

"As yet we can offer no scientific explanation for this observation," observes Dr. Nix, "but the nuns tell us that the cancer waits until they have finished their apostolic mission."

Mini-eye on blood pressure

An electronic device only 2/100ths of an inch thick may one day be implanted in the human body to measure blood pressure. Barely visible to the eye, the unit has been placed in the arteries and hearts of laboratory animals to measure blood pressure while using 100 times less power than conventional devices.

Dr. Bernard Lown, cardiologist at Harvard Medical School, who developed the miniature instrument in cooperation with the National Aeronautics and Space Administration, says its extremely small size makes possible tests in vessels hitherto inaccessible for monitoring.

Known as a "cardiovascular pressure transducer," the semiconductor device can follow faithfully the small pressure variations which provide medical researchers with vital information about the heart and blood circulation. It will be possible to implant the device in a human being and observe continuously the blood flow and pressure.

Dr. Lown plans to apply the transducer at Peter Bent Brigham Hospital to provide data on patients who have suffered heart attacks.

The electronically active part of the transducer is less than a thousandth of an inch in diameter, about the thickness of a human hair.

Old love-patters not in vogue

The aged man who reaches out to touch and pat the smooth and inviting skin of a youngster is often looked upon with suspicion and disapproval. Yet the response is usually that of a person who hungers for human and social affection, says Dr. Jack Weinberg of Chicago.

"He becomes the prototype of the dangerous molester despite the fact that statistically he ranks low on that scale." Dr. Weinberg adds, "The number of aged molesters is quite negligible when compared to the young adult molester."

The physician urges society to take into consideration "the sublimated and socially acceptable expressions such as touch or tactile contact which in the younger adult may be acceptable and natural.

"In a society which is extremely fashion conscious, the old are simply

not attractively packaged and have therefore lost their appeal. Seldom do the young, or even the old for that matter, take a second look at a passing old person."

Safe substitute for 'the pill'

A new birth control capsule that hopefully will provide protection for a year and eliminate the undesirable side effects of present oral contraceptives is under test in Michael Reese Hospital, Chicago. It is a hormone contained in a slow release capsule that is inserted into the womb. It alters the womb lining so that a fertilized egg cannot adhere.

The capsule has been tested on rhesus monkeys and on volunteer patients, but it will not be available until further trials prove its effectiveness and Food and Drug Administration approval is obtained.

Apart from freeing women of close calendar-watching required for the pill, the potential benefit of the capsule is the elimination of blood clots, high blood pressure, migraine headaches and other side effects some alarmed physicians contend are complicating use of the pill. Introduced in 1961, oral contraceptives have been used by an estimated 10,000,000 American women. The effectiveness is believed to be more than 99 percent, but the dropout rate is significant because of the controversy in medical circles over its alleged hazards.

High cost of the pill has resulted in widespread use of the inexpensive intrauterine device (IUD) in the lower income areas of the world. However, the IUD's effectiveness does not compare with the near-perfect record of the pill. If the IUD concept could be adapted to a biochemical rather than a mechanical device, the impact on the world population explosion would be enormous.

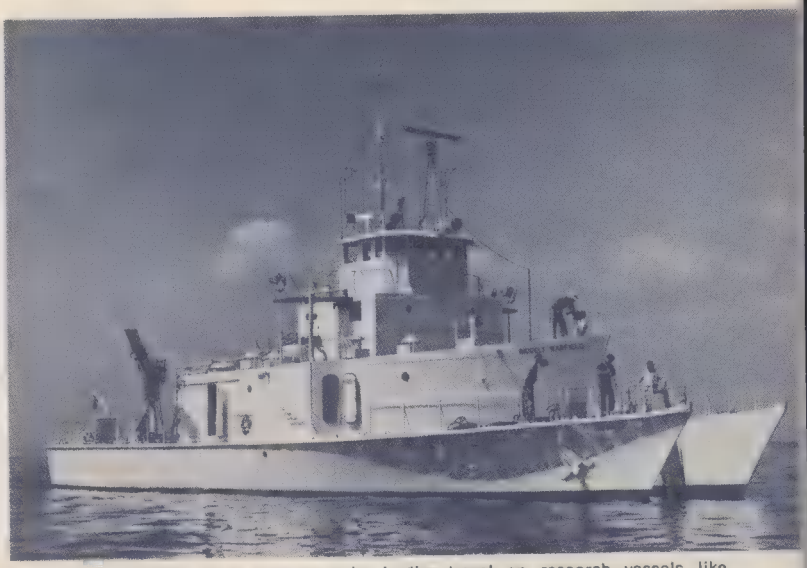
Dr. Antonio Scommegna of Michael Reese believes this can be achieved by avoiding involvement of the total body metabolism and confining the contraceptive action to a localized area. Hormones placed directly at the site of the terminal action of the conception process—the endometrium or lining of the womb —will produce the desired effect without interfering with the powerful pituitary and hypothalamus mechanisms.

Inheriting heart defects

Surgery on children with congenital heart disease now has been carried on for enough years so that these patients are old enough to marry and have children. What are the chances of their offspring having congenital heart disease?

Dr. Paul F. Dodd of Baylor University finds the possibility of a parent with one form of heart disease (atrial septal defect) having a child with a similar defect is 2.6 percent —about 37 times the risk for the general population. For another form of congenital heart disease (ventricular septal defect), the possibility is about 3.7 percent, or 21 times the general population incidence.

Dr. Dodd's figures were based on a survey of 308 adults who had undergone surgery for correction of congenital heart disease. Of these, 208 were married and 130 were parents of a total of 352 children. Eleven of the children had congenital heart defects.



Part of the excitement of oceanography is the travel on research vessels like this one, the *Ridgely Warfield*, a twin-hulled catamaran of relatively great speed and stability. Some oceanographers travel all over the world on boats like this.

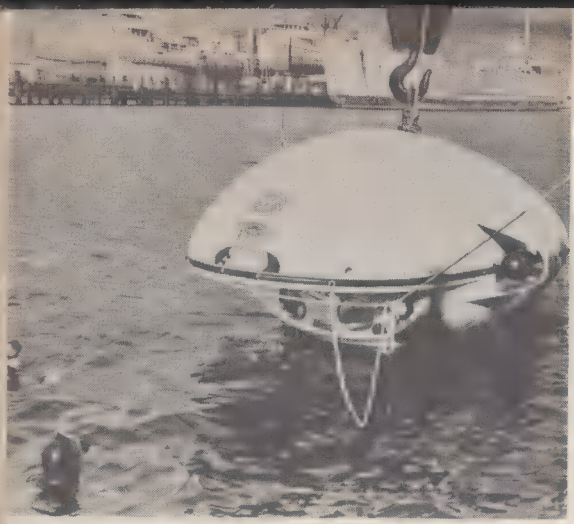
Fascinating new careers in oceanography

by Creighton Peet

CAREERS in oceanography are luring more and more young scientists who want to be "where the action is" in the scientific world. They're looking for excitement, solid intellectual challenge and the adventure of making deep-sea discoveries in one of science's most active frontiers—the world of "inner space." These pioneers are exploring an unbelievably vast area which has already begun to furnish food, chemicals and minerals in huge quantities.

In 1967 ocean products, exclusive of oil and gas, were valued at almost $1 billion. And since the oceans cover 71 percent of the earth, their importance to the human race in years to come will be immense.

So far, only a minute part of the oceans' resources has been tapped. The average depth of the ocean beyond the continental shelves is around two and one half miles, and



Small two- and three-man submersibles such as these three are typical of the kind of vehicles being experimented with by oceanographers today. Numerous companies are involved in their development: sub at left was designed by General Dynamics, the one above left was developed by Westinghouse. The larger submarine above was developed by General Dynamics and is constructed of aluminum; it can stay submerged with three men for about 32 hours. All three are equipped with closed circuit television, cameras, obstacle avoidance sonar, fathometers and communications systems. The smaller subs have a shorter travel range and can stay submerged for only about eight hours, but are more maneuverable. Many young oceanographers are experimenting with vehicles like these.

there are some underwater valleys five, six or even seven miles deep in which only the most superficial exploration has been done so far. The recovery of minerals in any commercial quantities from these great depths is impossible with the equipment now in use. The fact is, oceanography is still a very new science, and only a very small portion of the ocean floor has even been accurately mapped or sampled, although many agencies in all major countries have done some work. The U.S. Navy has mapped the ocean floor in several places by taking soundings as little as three miles apart. In other areas soundings are as much as 1,000 miles apart.

Like our ventures into *outer* space, these probes into the sea are extremely costly—many research cruises by large ships run into the millions of dollars. The Navy's new NR-1, a 140-foot nuclear-powered research submarine launched in January 1969, cost nearly $100 million. Although it will carry only seven men, it can stay down indefinitely and will have military as well as scientific value.

A surprising variety of companies is getting into oceanography today: the United Aircraft Corp., Lock-

heed, Grumman, General Dynamics, Westinghouse and General Electric are all building undersea vehicles, many for the Navy, which is probably doing more deep-sea work than any other agency along both the Florida and California coasts.

Although they are well aware that there will be no financial returns for a long time, many big companies also purchase these undersea vehicles simply because they want to be in on this new and slightly mysterious business.

The oil companies long ago made a big thing of underwater drilling, and some scientists feel that as they move into deeper waters on the continental shelf they will tap absolutely unlimited p o o l s of oil currently being formed deep under the ocean floor. For such operations, oceanographers will be in demand.

Practically every mineral we use is found in the ocean, but so far only salt, bromine and magnesium are successfully mined from the oceans in any commercial quantities. Placer deposits of gold, platinum and even diamonds are sometimes found near the shore, carried there by strong river currents.

Beyond the continental shelf—which extends 200 to 750 miles from the shore and is about 600 feet deep—nodules of copper, colbalt, nickel and manganese are found; but up to now, no means has been devised to mine them profitably. Experiments have shown that it costs twice as much to recover materials from great depths as from mines ashore. This is one of the things that makes oceanography so fascinating—knowing that vast amounts of valuable minerals are lying on the ocean floor, or under it, just waiting for the right intellect to come along and figure out a way to bring them to the surface.

All oceanographers are interested in the development of new deep-diving gear which will enable men to work on the ocean floor for many hours at a time. Older systems require that a man return to the surface after as little as half an hour and spend boring, non-productive periods in decompression chambers in order to prevent the "bends."

Land-based jobs too

A few radically new types of diving equipment have partly solved some of the problems. The Navy's Project Tektite recently maintained four men 42 feet beneath the Caribbean for 60 days. The pressure in their habitat, which contained their living quarters and laboratory, was equal to that of the water outside. This made it possible for men to pass out into the ocean through an open hatch and go on swimming excursions to collect marine specimens, measure currents and make geological surveys. Wearing diving gear also pressurized for this depth, they were able to work for many hours on the ocean floor, returning to their habitat with no need for decompression.

However, not all oceanographers go down to the sea in diving gear. Many work in shore-based laboratories feeding data into computers, w h i l e others spend weeks, even months examining, classifying and preserving materials either dredged up by long cables or collected by divers who use the laboratory ship as a base.

For the young person who demands the unusual in his profession,

oceanography is an absolutely wide-open business. An afternoon spent talking among oceanography students at Columbia University's Lamont Geological Observatory revealed clearly that everybody in this field, without exception, had come from some other science. Douglas Tolderlund, who started out as an undergraduate in geology, had switched to oceanography as soon as he got his degree, ending up with a Ph.D. in this field. Born in Newport, R.I., Doug had always felt at home on the ocean. Earlier during a hitch in the Navy he had found a net aboard ship and collected samples of plankton, the microscopic animals which form the first mouthful in the ocean food chain. Now that he has his degree he has decided to "go commercial" (a phrase you hear a lot among scientists) and will work for Raytheon doing research on the changes caused by the discharge of warm water from nuclear cooling systems into rivers. Conservationists are complaining about this, and big companies are concerned.

Prof. J. Lamar Worzel, associate director of the observatory, recalls that when he was an undergraduate at Lehigh University many years ago, all students attended a series of lectures. After hearing a talk on oceanography he decided to take up this work rather than that in which he was majoring, physics. For one thing, he said, the outdoor life appealed to him. He now specializes in cores dug from the ocean bed as part of his work on 30 voyages on all the world's oceans.

Sam Gerard, another graduate, was much elated over an expedition from which he had just returned aboard the R/V (Research Vessel) *Glomar Challenger,* a drilling vessel engaged by five universities for special work. Working in the Gulf of Mexico, the Caribbean and the Atlantic, they had made a series of cores, drilling under 20,000 feet of water to a depth of 2,000 feet below the ocean floor, reaching through the entire sedimentary column to crystalline "basement" rock in some cases. (See "The New Time Machine," April 1969.)

Opportunities are vast

Gerard, an American, did some of his college work at McGill University, specializing in climatology, setting himself a fantastic project—reconstructing the climate of North America for the past million years. He explained that most oceanographic work, perhaps as much as 90 percent, is financed by the Federal Government, chiefly the National Science Foundation, while most of the heavy deep-sea research vehicles belong to the Navy. Here, research is also concerned with the development of submarines and other submersibles of military value.

John W. Jones, a Briton who studied at Cambridge and is now at the Lamont Observatory, says that one of the things which attracted him to this field was that, "this is a business in which you can make a breakthrough early—while you're young. In so many branches of science it is getting extremely hard to make a name."

John has already spent 15 months at sea on various expeditions. As for a job after graduation, he says oceanographers are hired as consultants by mining companies and engineers building harbors, and oppor-

"Oceanography is a field in which you can make a breakthrough early— while you are young."

tunities with oil companies are big.

Oceanographers are often internationalists, studying and working in many countries, spending long months at sea and stopping off in foreign ports, something which has attracted a lot of students. Several told me they liked the idea of working in the open, although they admitted that the physical work on board a research vessel was often very tough, and that while you supposedly had an eight-hour day, when a big job was under way you often worked 14 to 16 hours.

"The first two months on a ship can make you pretty tired and disgusted with the monotony," one man told me, "but at the end of six months you are a fanatic and swear to go back and study until you are as good as the chief scientist aboard."

Many students feel that an oceanographic institution might be rated by the number and size of its ocean-going vessels, which would make the Scripps Institution of Oceanography at La Jolla, Calif., the Woods Hole Oceanographic Institution at Woods Hole, Mass., Columbia's Lamont Geological Observatory at Palisades, N.Y., and Johns Hopkins University's Chesapeake Bay Institute at Baltimore, Md., the leaders in this field. Actually, the largest oceanographic research agency is the Office of Naval Research which supports basic and applied oceanic studies at public and private agencies.

One thing, if you are interested in a career in oceanography be sure to pick a university specializing in your particular field. Usually the top professors determine a school's slant. So correspond with—or better visit—an institution you are considering. If your specialty is marine biology for example, and a school is strong on physical oceanography (physical properties of sea water, its chemical content, waves, currents, rates of sound transmission, etc.) it may not be the place for you. The major areas of investigation in oceanography are biology, chemistry, geology, seismology, ocean engineering and a few others. Later, when it comes to getting a job, a graduate may end up almost anywhere from being a consultant for a big fishing fleet to piloting an archaeological expedition searching for the remains of lost civilizations. ■

For further reading

ENTERING OCEANOGRAPHY. *S. S. Raup, Chesapeake Bay Institute of Johns Hopkins University, Baltimore. Brief but very informative few pages.*

OPPORTUNITIES IN OCEANOGRAPHY. *Booklet from Smithsonian Press, Washington, D.C. $1. Short, informative.*

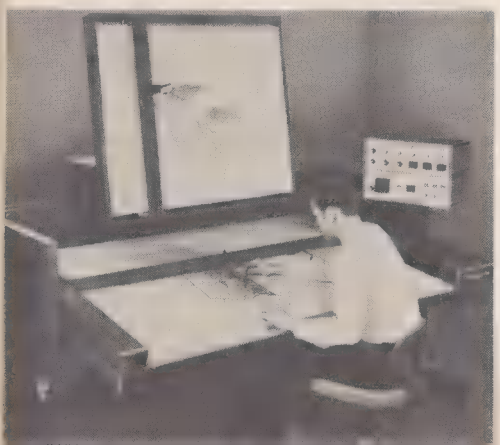
OUR NATION AND THE SEA. *U.S. Gov't Printing Office. $2.75. Mass of interesting detail in 300 pages.*

YOUR FUTURE IN OCEANOGRAPHY. *Norman H. Gaber; Richards Roson Press, 29 E. 21st St., N.Y. City. $4. Excellent, thorough; lists of colleges, trade associations, information on where Federal and state money is spent, advice on jobs, etc.*

NEW FOR INDUSTRY

METAL WITH A MEMORY is called Nitinol by its developer, Goodyear Rubber, Akron, Ohio. NASA is interested in the metal because of its unique ability to coil and uncoil. The device consists of four Nitinol wires incased in transparent plastic. When heated, the two inner wires cause the unit to coil. The outer two wires, when heated, cause it to uncoil to ■ straight 18 inches. The metal, formed from 55 percent nickel and 45 percent titanium, amazes everyone, but so far the experts are still looking for a practical application.

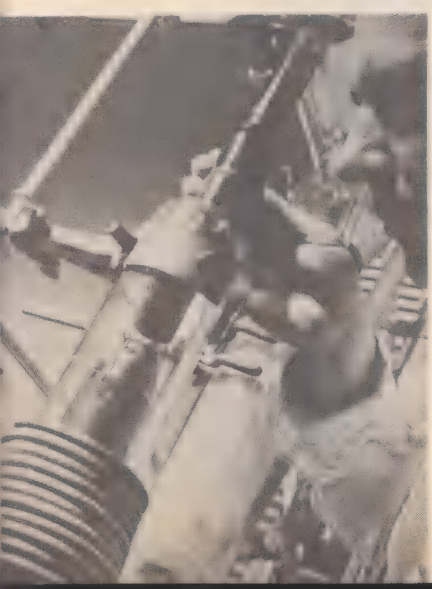
EASY TO BUILD LASERS may be manufactured for less than $500, if Bell Telephone Labs, Murray Hill, N.J., are correct in their conclusions. The one at left is a metal vapor device which has been called the most efficient and least expensive continuous-wave laser ever developed. The device uses vapors of cadmium, tin and zinc and operates at temperatures ranging from 200°C. to 1000°C. The main component of the new lasers is a simple glass or quartz discharge tube such as is used in helium-neon lasers. This development may satisfy the growing requests for inexpensive laser.



PERSPECTIVE DRAWINGS FASTER and cheaper are possible because of improvements on a device first introduced four years ago. Machine called Illustromat introduced by Perspective Systems, Inc., Seattle, Wash., can produce 3-D drawings 10 to 20 times faster than it can be done manually by an illustrator, and recent changes and simplifications have reduced the price of the machine from the original $50,000 to less than $20,000. Illustromat is a computerized, electronic drawing system that can accurately produce drawings from those of simple nature to the most complex 3-D perspective illustrations.

CRYSTAL-CLEAR NYLON called Milvex (right) is an improvement over present nylons not only because of its unusual clarity and transparency but also because of its water resistance, tensile strength and adhesive qualities, according to its developer, the Chemical Division of General Mills, Minneapolis, Minn. Most other nylons are opaque, not transparent; they readily absorb water and are not as flexible as Milvex. General Mills is building a plant in Kankakee, Ill., to manufacture the nylon resins soon to reach general markets.

VACUUM FUSION FURNACE (below) looks a lot like some sort of giant hypodermic needle, but what it really does is determine the gas content of metals. General Electric Company's Lamp Glass Department, Cleveland, manufactures the quartz thimble in the center section which holds a graphite crucible for melted samples. Thimble is made of fused quartz tubing, because quartz is the only inert material that can withstand the high temperatures—sometimes as high as 1,650°C. to 2,400°C. during the laboratory operation.



ELECTRIC TOOL FOR UNDERWATER USE has been developed by the Oceanautic Manufacturing & Research Co., Cincinnati. Called "Seapower," (below) the tool is designed to be used by divers in various kinds of underwater work: everything from recovering sunken treasure to repairing bridge supports. The tool can be used as a drill, circular saw, tap, adjustable nut runner, screwdriver or a power source for driving many types of underwater equipment. Tool operates on a 110-volt AC power source even at great depths.

Drawing: Ellen Williams

New parents for schizophrenics

Mental patients are being cured by letting them re-live their childhoods—baby bottles, thumb-sucking and tantrums included.

by Seymour Shubin

"MAMA?"

"Yes, Sheilah."

"I'm not u n h a p p y anymore, Mama."

"That's wonderful."

"I'm not unhappy anymore."

"Good. We're all delighted."

"I'm not u n h a p p y anymore, Mama."

"Wonderful. But no more now. We've heard you."

Sheilah, who is 16, settled back in her chair. Although her face was tear-streaked, it was just a b o u t expressionless, as had b e e n her voice. Almost unobtrusively, one of

her "sisters"—a petite woman of 28, clutching a Raggedy Ann doll—took Sheilah's hand and, as she'd been doing off and on, began stroking it gently to comfort her.

I was sitting with Mr. and Mrs. Morris Schiff and five of their 16 "children" in the living room of their home, which is near the outskirts of Fredericksburg, Va. Sheilah, who had been crying intermittently for no apparent reason, was only three days out of a mental hospital. She had been brought here by a psychiatrist, *not* because she was better or these were her real parents, but because she was so sick the psychiatrist felt that this home and these people might be her only hope of ever getting well.

Sheilah is a schizophrenic, as are all but three of the Schiffs' other "children." And these three—boys of 8, 11 and 13—are the only members of the "family" who are the Schiffs' natural children.

"We think of *all* of them as our own, even though we hope they may only have to stay with us a year or two," Mrs. Schiff said. "Although most of them do have parents, the parents have to give us complete charge of them for as long as they're here. In fact, we have the parents actually tell them in front of us that they're to look on us as their new mother and father and that this is their new home. However, the children can see their parents if they want to. And before we discharge a child, we encourage him to see his parents to test out his feelings."

Mr. and Mrs. Schiff are psychiatric social workers who, since 1966, have been running a most unusual rehabilitation program for young schizophrenics, a program that has shown such exciting results in so short a time that they cannot begin to accept all the patients referred to them by psychiatrists and mental institutions. Furthermore, this remarkable couple is doing it at a considerable financial cost to themselves.

Among the "children" who were home at the time (regardless of their age they are all referred to as children by the Schiffs until they "grow up") was a 29-year-old former associate professor of sociology who had suffered a serious breakdown while preparing for his doctorate; a young man of 22, with a pleasant smile and seemingly easy manner of talking, who, until the Schiffs had taken him in about a year ago, had spent the past nine years—a catatonic—in a state hospital; and the woman with the rag doll who, it turned out, was married and was one of three day patients the Schiffs had. A professional artist, she had tried to kill herself following the death of her mother, and for the past six months her husband has been bringing her here each morning and picking her up each evening after dinner.

"The other children are at school or work," Mrs. Schiff said. "You'll meet them later. You'll also get to meet two of the ones we've been able to discharge. They're attending the University of Virginia and are coming in to meet you."

"How many have you been able to discharge altogether?"

"Six. So far we haven't had to send anyone back to a hospital, although three gave up on *us*. They quit after a week or so."

Reprinted with permission from SK&F Psychiatric Reporter ©1969 by Smith, Kline and French Laboratories.

Most of the therapy the patients receive is based upon the principles of "transactional analysis." The Schiffs explained that this is a theory of treatment (Dr. Eric Berne is probably its leading proponent) that describes an individual's personality structure as made up of three separate ego states—one, representing the biological and expressive child; two, the autonomous adult; and, three, the attitudes and behavior of the parents. One of the major causes of mental illness is when this third ego state, referred to as the "Parent," is too strong for the others.

They 're-parent' patients

Mrs. Schiff, who is on the Advisory Board of the International Transactional Analysis Association and serves as a consultant for several agencies in Washington, D.C., said that what she and her husband basically try to do is "re-parent" the patients.

"We try to give them a new set of values and experiences, a new 'script' for living which will replace the old ones their parents gave them which told them, in effect, to be failures. But to do all of this we have to work with them when they're very sick, when they're deeply regressed —to the point of infancy, if possible —and then work with them through stage after stage of development."

Their project, she continued, had its start in Charlottesville where she had a 19-year-old boy named Dennis as a private patient.

"He had spent some time in a mental hospital and had been diagnosed as a paranoid schizophrenic with homicidal tendencies. The reason he was out of the hospital was that his parents didn't want to pay for treatment—in fact, didn't want to have *anything* to do with him. He was real scary looking—was filthy, had long, matted hair and a weird look in his eyes. People thought I was crazy to take him on as a patient."

"Which is nothing compared to what they thought," Mr. Schiff added, "when we decided to have him come live with us. Actually even *he* was afraid he was dangerous. In fact, while he was coming in as a private patient he warned my wife not to be alone with him, that I should always be with her during his visits. Which is why I was there when this particular incident happened that led us to take him in."

"Before we go into that," Mrs. Schiff said, "you should know that before we took Dennis in my husband and I had been giving a lot of thought to the theoretical possibilities of re-parenting children. Well, anyway, on this particular visit Dennis spontaneously regressed into an infant. He suddenly climbed on my lap, clutching me and making all kinds of baby sounds. It was so terribly pathetic. Here was a boy—he was a college student and actually very bright—who could not function anymore. If we didn't take him in, it meant back to the hospital for him, and we could just see him spending the rest of his days there."

"But weren't you afraid? For your children? Yourselves?"

"Yes, we were somewhat concerned, of course, but you had to see his face while he was on my wife's lap to really understand why we did it. He *looked* so much like an infant, a helpless infant, that he didn't seem like anyone to be really

One patient with homicidal tendencies showed up at the Schiffs' house with an arsenal of guns.

afraid of. So we took him in, though he showed up with an arsenal."

"Arsenal?"

"Yes," he said with a smile, "it turned out he was a gun collector. But he didn't put up any fuss when we took them away."

"Actually," said Mrs. Schiff, "we didn't go into this in as haphazard a way as it might sound. From the sessions I'd had with him, I felt we could help him and that if there was *any* danger at all it would be to my husband and me—who were 'authority figures'—and not the children. In fact, he was scared of the children, particularly the youngest. And he never did cause any real trouble. For months he literally acted like an infant, crawled, drooled, went through a feces-smearing stage, and even began taking a bottle. However, all through this and later stages of development, he was very articulate and was able to describe what he was going through and he helped us develop a lot of our theories."

"Is he still here?"

"No, we discharged him several months ago. He's one of those coming to see you this evening."

Do many of the patients go through a period of drinking a bottle? The former college professor, who had been with the Schiffs five months, spoke up. "Yes. I felt silly at first about wanting to do it but I got a great deal of support from Mom and Dad and the kids. Before I'd gotten sick, one of my problems was that I was *afraid* of being dependent—of *being* a baby. Here I could let myself go."

"Do you still drink a bottle?"

"No. I don't have the need to anymore. I'm now"—he looked at the Schiffs for confirmation—"emotionally equivalent to about 15, wouldn't you say?"

"I would say so," Mrs. Schiff agreed.

She then went on to tell me that, within a couple months after taking in Dennis, they felt confident enough to take in two other patients. They moved to their present home in December 1966. To house the additional patients they started accepting, they converted the porch and garage into dormitory-style bedrooms and put bunk beds into other bedrooms.

Any complaints from neighbors?

"Yes," Mr. Schiff replied, "and although things have quieted down considerably, now and then someone will complain to the zoning board that we have no right being in a residential neighborhood because, they claim, we're not really a family but are running an institution. However, we've been allowed to stay."

In fact, the community as a whole has given them its support. The schools, for instance, permit certain patients to attend classes part-time. The police have been particularly helpful and considerate, returning runaways and patients who get lost in town. Then in 1967, soon after the Schiffs set up the project as a nonprofit corporation, the local chapter of the Virginia Association for Mental Health got behind it, appointed three of its members as directors, and started a fund-raising campaign. And Dr. Donald Reed,

who is director of the Fredericksburg Mental Hygiene Clinic (a state facility where the Schiffs worked for a time) and is the only psychiatrist in an eight-county area, serves as a consultant without charge.

As for patient fees, they are based on ability to pay, something that plays little if any part in the Schiffs' decision about whom to take in. For instance, at the present time they have five free patients, one at only $100 a month, two at $125, one at $200 and another at $300. (Day patients pay $25 a week.) This and the money the mental health association has raised far from cover the costs, which include feeding and clothing the patients, giving them spending money and taking care of all their other needs. The Schiffs—he has a private practice as a therapist and she also sees some patients part-time—help make up the deficit, which averages about $800 a month.

"We look on ourselves," Mr. Schiff grinned, "as a typical middle-class family that's living a little above its income."

Just then Sheilah, who had been sitting by staring at the floor, began crying softly again.

"Don't, Sheil," urged the young man who had once been catatonic. "Please, don't," and he too, like the married woman with the doll, began stroking one of her hands. "We've all been through this at the beginning—feeling strange and scared."

When nothing seemed to work, Mrs. Schiff said, "If you're going to fuss like that when we're talking to company, you're going to have to stand in the corner."

"Can I cry in the corner?"

"Sure."

But it was only after a few moments in the corner that she said, "Mama? Can I sit on your lap, Mama?"

"Of course."

So she came over and sat on her lap, her sobs turning into dry gasps and then finally easing off completely.

"I love you, Mama."

"And I love you."

Then Mrs. Schiff, still holding her close, said to me, "Everything is highly structured here; we don't put up with unacceptable behavior. We treat the children according to their behavior, not their size or age."

I wondered how the Schiffs' natural children took to having so many "brothers" and "sisters."

"They haven't had any big problem with it that we know about," said Mr. Schiff, "and they're *not* the kind of kids who keep things hidden. Furthermore, anyone in the house who *does* have a problem can ask for a group meeting at any time. We usually have several a day, as well as a regular one on Fridays."

A little later that day, Dr. Reed and Mrs. Lillian Bowen, executive director of the local chapter of the mental health association and the one who had first let me know about the Schiffs, stopped by to say hello.

Dr. Reed told me very frankly that when he'd first become acquainted with the project he'd found some of the techniques a little hard to take. "It was, well—a strange feeling to see them treating grown people like babies, letting them have bottles, pacifiers, stroking them as if they were infants in a crib."

He said, further, that he'd even advised them against accepting certain patients, for he felt that some psychiatrists were simply dumping

Fully-grown adults with mental problems even go through the bed-wetting, feces-smearing stage.

their own failures on the Schiffs.

"But their techniques and the richness of this environment have proved to be very effective. Just about every patient who *wasn't* in a hospital at the time the Schiffs got hold of them, was headed for one—and most mental hospitals are places where patients learn to *stay* sick. In fact, the prognosis on the record of almost every person here was so bleak, so depressing that I honestly don't think I would have believed the results the Schiffs have been getting if I didn't actually see it."

As the afternoon drew on, other members of the "family"—the youngest patient is 13—began coming in, putting away their books, bantering, going to the refrigerator for a piece of fruit or a glass of milk: as "normal" looking and acting young people as I've seen. I was introduced to each of them and to the Schiff's own children.

Then, toward evening, Dennis and the other former patient, an attractive, vivacious girl named Betty, arrived from college. After having dinner around the largest table I've ever seen in a private home I chatted with Dennis and Betty while Mrs. Schiff spoon-fed food she'd mixed in a blender to a girl who was having trouble eating.

Dennis looked like anything but the person the Schiffs had described as first meeting. Personable, neatly dressed, he told me he was expecting all A's on his next report.

"Oh, but I was a real freak all right. Not only was I going to kill every cop, I was even sure *mailmen* were out to get me. If Mom and Dad hadn't helped me, chances are you might have read about me in the paper as one of those guys who starts shooting out of a window."

Betty, on the other hand, was a little surprised when Mrs. Schiff mentioned to her for the first time that she was one of those whom Dr. Reed had advised them against accepting.

"Really? Why?"

"*Gawd*!" one of the others exclaimed, clapping a hand to his forehead. "You couldn't leave her along five minutes without her trying to kill herself. Someone had to be with her every minute of the day for at least five months. One time—I'll never forget—the lights went out and we all went to check the fuses. Suddenly someone said, "We've left Betty!" We ran to her room and sure enough there she was cutting her wrists."

"We spent more time literally sitting on her, trying to control her," another said. "I think she was in the emergency ward three times a week."

Betty looked at Mrs. Schiff with a smile.

"So I had a few hangups," she said. ■

For further reading

THE THERAPEUTIC RELATIONSHIP AND ITS IMPACT: A STUDY OF PSYCHOTHERAPY WITH SCHIZOPHRENICS. *Edited by Carl R. Rogers with collaboration of Eugene T. Gendlin, Donald J. Kiesler and Charles B. Truax. University of Wisconsin Press. 1967.*

ISAAC ASIMOV EXPLAINS

Each month Dr. Isaac Asimov chooses one of the questions you send in to answer. He does not make the job easy on himself, for in past months he has written about such things as relativity, parity and the basic nature of light. Following Dr. Asimov's answer are the answers to some of your other questions written by regular members of the *Science Digest* staff.

Traveling faster than light

I am told that blue light visible in the water surrounding a heavy water reactor pile is caused by particles traveling faster than light. How is this possible in view of the relativity theory?

It is often stated that particles cannot travel "faster than light" and that the "speed of light" is the ultimate limit of speed.

Actually, if we say this we are not saying enough, for light travels at different speeds through different media. Light travels fastest through a vacuum, in which case it moves at a speed of 186,281 miles per second. It is *this* which is the ultimate speed.

We should say, then, that particles cannot travel "faster than the speed of light in a vacuum" if we want to be accurate.

Light traveling through any transparent medium other than a vacuum always travels more slowly than it does in a vacuum, in some cases much more slowly. The more slowly it travels in a particular medium, the greater the angle through which it bends (refraction) when it enters that medium from a vacuum at an oblique angle. The amount of bending is defined by a quantity termed the "index of refraction."

If the speed of light in a vacuum is divided by the index of refraction of a particular medium, we find the speed of light in that medium. The index of refraction of air at ordinary pressures and temperatures is about

1.0003, so that the speed of light in air is 186,281 divided by 1.0003, or 186,225 miles per second. This is 56 miles per second less than the speed of light in a vacuum.

The index of refraction of water is 1.33, of ordinary kinds of glass 1.7 and of diamond 2.42. This means that light travels at a speed of 140,000 miles per second through water, 110,000 miles per second through glass and only 77,000 miles per second through diamond.

Particles can't travel faster than 186,281 miles per second, but they can surely travel at, say, 160,000 miles per second, even through water. When they do this they are traveling through water faster than the speed of light *in water*. In fact, it is possible for particles to travel faster than light in any medium *but* vacuum.

Particles traveling faster than light in some non-vacuum medium emit a blue light that trails behind. The angle at which it trails behind depends on how much faster than the speed of light in that medium the particle is going.

The first to observe this blue light emitted by faster-than-light particles was a Russian physicist named Pavel A. Cerenkov, who reported it in 1934. The light is therefore called "Cerenkov radiation." In 1937, two other Russian physicists, Ilya M. Frank and Igor Y. Tamm, explained the existence of this light by relating it to the relative speeds of particle and light in that medium (as I have done here). The result was that in 1958, all three men were awarded the Nobel prize in physics.

Special instruments, "Cerenkov counters," have been designed to detect such radiation, measure its intensity and the direction in which it is given off.

Cerenkov counters are particularly useful because they are activated only by very fast particles and because the speed of those particles is easily estimated from the angle at which the light is emitted. Very energetic cosmic rays move at a speed so close to that of light in a vacuum that they will produce Cerenkov radiation even in air.

Tachyons, which are hypothetical particles that can only move *faster* than the speed of light in a vacuum, would leave a very brief flash of Cerenkov radiation even in a vacuum. It is by detecting such Cerenkov radiation that physicists hope to prove the actual existence of tachyons (*if* they exist).—*Isaac Asimov*

What is the difference between surface water and ground water?

Just as its name implies, surface water is that fresh water which is accumulated on the earth's surface. Lakes, rivers, reservoirs, streams, swamps and any other natural storage basins contain surface water. These areas are all open to the sky and accessible to rainfall. All surface water areas are not natural, of course, as there are many man-made lakes and reservoirs. Rain, melting glaciers and underground water are all sources of replenishment for surface water bodies.

Ground water on the other hand is that fresh water (from rain, melting snow or ice) which soaks into the soil. This water first enters a layer of earth containing air and

Advertisement

Why Do You Have A Poor Memory?

A noted publisher in Chicago reports there is a simple technique for acquiring a powerful memory which can pay you real dividends in both business and social advancement and works like magic to give you added poise, necessary self-confidence and greater popularity.

According to this publisher, many people do not realize how much they could influence others simply by remembering accurately everything they see, hear or read. Whether in business, at social functions or even in casual conversations with new acquaintances, there are ways in which you can dominate each situation by your ability to remember.

To acquaint the readers of this publication with the easy-to-follow rules for developing skill in remembering anything you choose to remember, the publishers have printed full details of their self-training method in a new booklet, "Adventures in Memory," which will be mailed free to anyone who requests it. No obligation. Send your name, address, and zip code to: Memory Studies, 835 Diversey Parkway, Dept. 690-018, Chicago, Ill. 60614. A postcard will do.

water surrounding rock fragments or soil particles. This particular area is called the zone of aeration. The water gradually replaces the air, though, as it seeps through the soil, until the soil is finally saturated. The top of this saturated zone is known as the water table, which will be discussed shortly. At the bottom of the zone very often is bedrock, which can be 10 miles below the surface.

As the ground water moves through the saturated zone, it replenishes dry or low-water volume cavities in the ground which must have plenty of water if they are to keep lakes and wells supplied. Sometimes vegetation draws water from the saturated zone upwards to its roots. Too, the water can become trapped deep within the bowels of the earth and remain in natural underground reservoirs for many years.

Underground water is not limited to regions of the earth with high precipitation. Deserts, plains, many arid sections of the world, as well as mountains, rivers, cities, have a great deal of underground water. There is even underground water beneath the oceans.

Now, back to the water table mentioned earlier, which is the top of the saturated zone beneath the earth. If the water table in a certain region is at ground level, then what will occur? A swamp, of course, for the soil is saturated at that point. If the table happens to be above the land's surface, then natural lakes or ponds are formed. ■

Please address all questions to Isaac Asimov Explains, Science Digest Magazine, 575 Lexington Avenue, New York, N. Y. 10022

A tunnel-full of sonic booms

TO FIND OUT how sonic booms affect materials and people, pressure waves like those generated by high-velocity aircraft are being produced on the ground.

The booms are simulated by releasing compressed air into one end of a 100-foot duct lying on its side at General Applied Science Laboratories, Inc., Westbury, L.I.

Roger Tomboulian, manager of experimental sciences, and Dr. Simon Slutsky, a consultant, recently got Patent 3,442,115 for the company on the boom simulator.

A plaster model of ground terrain, such as a valley, can be placed in the duct to illustrate variations in sound intensity. In studies begun for the National Aeronautics and Space Administration and the Federal Aviation Administration, it is planned to build and furnish a room adjacent to the duct and separated from it by a window.

With people in the room, the generated waves will reproduce conditions in an apartment subjected to actual booms.

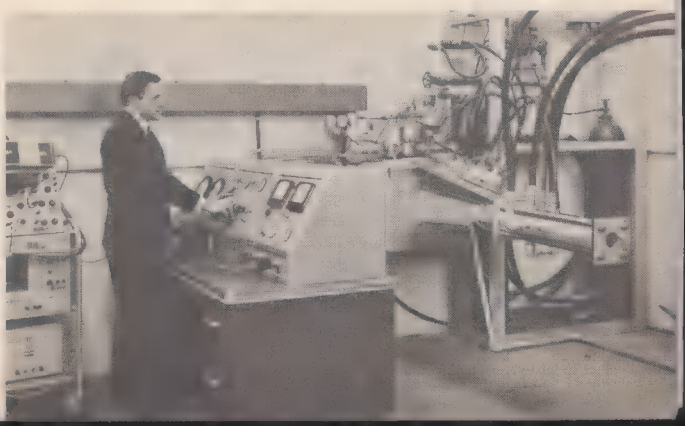
The duct, or tunnel, is made of reinforced concrete eight inches thick and is shaped like a horn but square in cross-section. At the large open end, which is 8 x 8 feet, an absorber has been installed to eliminate inside echoes.

The valve that releases the compressed air is programed to reproduce any desired shape of wave.

Tomboulian reports that the simulated booms produce a mild noise outside the large end of the horn. He and others who have ventured inside during experiments have found that low-intensity sonic waves are tolerable to the eardrums.

General Applied Science plans to increase the size and range of its boom generator. The company specializes in aerodynamic research and instrument development.

—*Stacy V. Jones*



Sonic boom simulator control console is shown here being operated by one of its patent holders, Roger Tomboulian, manager of experimental sciences at General Applied Science Laboratories. Pressure waves like those from high-velocity aircraft are simulated on the ground by releasing compressed air into 100-foot duct. Ground experiments are being conducted to see how sonic booms affect materials and people.

QUIZ

How good a zoologist are you?

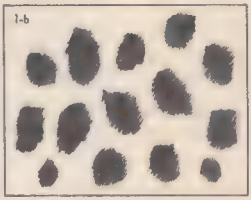
by John and Molly Daugherty

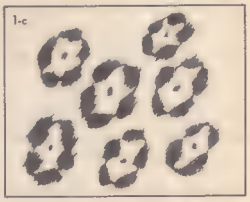
PRIMITIVE MAN had close contacts with the animal world around him. Gradually he learned to know which organisms benefited him and which did not. As civilization developed, he learned to domesticate some of the animals.

Today zoology has more practical importance than ever, and research is increasing in such areas as control of diseases, parasites, insects, rats and the improved breeding of domesticated animals.

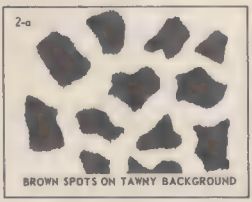
What do you know about these animals?

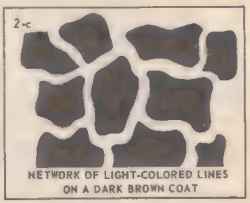
1. The leopard, cheetah and jaguar belong to the cat family (Felidae). This family includes the tiger, lion and even the domestic cat. The leopard, cheetah and jaguar have distinctive fur markings. Choose the picture which shows the fur markings of the cheetah.



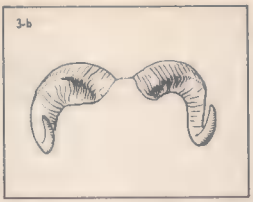


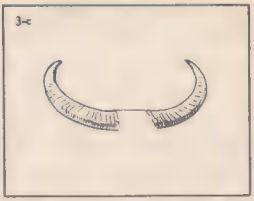
2. The giraffe is the tallest animal—about 18 feet or more, but only 8 to 12 feet at the shoulder. The okapi, the only living relative of the tall giraffe, is short-necked and only 5 feet tall. Found in the dense Congo forests, the okapi was unknown till the beginning of this century. Giraffes of Africa vary in their coat patterns and color. Choose the picture which shows a reticulated giraffe.



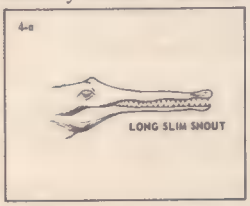


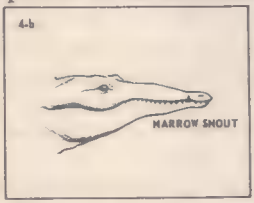
3. Horned animals show great variations in their horn configuration. These variations include size, shape, weight and spread. Bovidae is the family which includes antelopes, cattle and sheep. These animals have horns that do not shed. Choose the picture which shows the horns of the water buffalo.

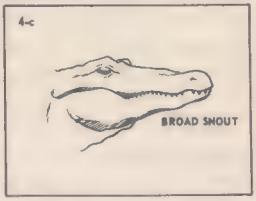




4. Reptiles are cold-blooded animals. Their body temperature is about the same as the immediate surroundings. Alligators, crocodiles and gavials are reptiles. The head and mouth features of these three differ enough to help identify them. Choose the picture of an American crocodile.







5. Llamas, vicuñas, guanacos and alpacas are known as South American camels. They feed on grasses and have a three-chambered stomach like the camel. Other cud-chewers have a four-chambered stomach. Choose the picture showing the head of the vicuña, noted for having the finest wool.

Drawings by Sam Sims

Answers:

1-b The cheetah's fur shows many small black spots, mostly round in shape, on a yellowish or tawny body. Other body colors occur, too, such as gray and buff. The cheetah (or hunting leopard) may be tamed and trained for hunting as it is used in India. It is the fastest running mammal, attaining speeds of up to 70 miles per hour over short distances of 100 yards or more. The cheetah doesn't stalk its prey but runs the prey down by sheer speed. The cheetah has no sheath of skin to hide its retracted claws as most cats do. Males weigh up to 200 pounds.

In 1-a, the leopard has a body fur marked with four or five dark spots forming a ring or rosette. On the head or limbs the spots are single. Males weigh up to 400 pounds.

In 1-c, the jaguar also has rosettes of dark spots on its body with a black spot or two in the center of each. Males may weigh up to 300 pounds but usually weigh about half that. Leopards and jaguars look very much alike but are never found together in the same environment.

2-c The reticulated giraffe has a dark brown coat divided by a network of light-colored or white lines. Baringo giraffes show less prominent reticulation, and their legs are lighter in color. Giraffes have no horns, but a pair of protuberances (or skin covered bony nobs) on the head.

In 2-a, you see the coat pattern of a nubian giraffe which has well separated brown spots on the tan background coat.

In 2-b, the masai giraffe has irregular brown spots which look like leaves on the tan or buff background coat.

3-c This shows the horns of a water buffalo which curve backward in a ring-like fashion. It is native to Indochina where they were domesticated for use as draft animals. Since then, they may be found in other countries. The Cape buffaloes, with larger ears, of southern Africa have never been domesticated. The water buffalo prefers marshy areas near streams or rivers. Water buffaloes are about the size of oxen.

In 3-a are the horns of the common eland, which is the largest of the antelopes. The horns of the different kinds of antelopes may be sickle-shaped, straight or twisted.

In 3-b, you see the horns of the bighorn sheep found in the western North American mountains.

4-b The American crocodile has a pointed snout, which is narrow compared to the rounded broad snout of the American alligator. Crocodiles in Africa and Asia have broader snouts. But the distinguishing feature of crocodiles lies in the fourth lower tooth on both sides of the jaw. When the jaws close, this tooth is visible outside the mouth and does not fit into any cavity of the upper jaw like other teeth. Crocodiles may weigh over a ton.

In 4-a, you see the head of the gavial with its long slender snout, used for catching fish. Gavials are found in southeast Asia.

In 4-c, you see the head of the American alligator. Its length varies from 10 to 19 feet and it has a broad snout and webbed fingers. Its Chinese counterpart is only 5 feet long and has unwebbed fingers. When the American alligator's mouth is closed, the upper teeth still show.

5-c Vicuñas live high in the Andes. Overhunting has reduced their number greatly, but the remaining small herds are protected. Vicuñas are small. The males weigh 150 pounds or less.

In 5-a, you see the llama which is domesticated and used as a beast of burden. Its fleece is made into cloth, its hide into leather and its meat is used for food.

In 5-b, you see the shaggy head of the alpaca. Its fleecy wool is in great demand, although it is rather coarse compared to that of the vicuña. Alpacas are domesticated.

Score yourself:

4-5 right	You're tops in zoology!
2-3 right	A visit to the zoo might help!
0-1 right	You've been hibernating!

FUNGUS DISEASES that fool the doctors

Fungus infections aren't always merely the splotchy skin, athlete's foot variety. Some are deadly, and this M.D. tells what medical detectives do to spot them.

by Joseph D. Wassersug, M.D.

THE MOLD or fungus that grows on a dry crust of bread or discolors and spoils a slice of melon may be the source of a valuable life-saving antibiotic and may, often as not, be eaten without any harm. Some fungi, like certain penicillins and mycins, may look bad, taste awful and yet be capable of *curing* deadly diseases.

It would be a mistake, however, to believe that all fungi are beneficial. Indeed, there are altogether too many that can cause serious disorders of the skin, lungs, intestines and nervous system.

It often takes a medical detective to distinguish friend from foe. Working with special culture techniques, a rogue's gallery of photomicrographs and special charts showing growth characteristics, doctors have recently been able to compile a "most wanted" list of fungus enemies. Yet, even today, some of the most notorious fungi are still able to fool the doctors.

In the United States, the most common of all serious fungus infections is *histoplasmosis*. Some fungi, like the *tinea* that cause athlete's foot, are superficial invaders attacking only the skin and hair. Not histoplasmosis. It goes deep into the lungs and shows up on X rays as shadows exactly like those caused by tuberculosis. Even the most experienced radiologist or chest specialist may be unable to distinguish the X ray of histoplasmosis from that of TB.

Histoplasmosis is caused by *Histoplasma capsulatum*, a fungus that grows in the soil almost anywhere. Although the disease is not infectious from person to person, epidemics can arise when fungus-laden dust is inhaled by many persons over a wide area.

Just about two decades ago doctors reported only 71 cases of histoplasmosis, almost all fatal. Today, it is estimated that there are between 30 million to 40 million infected people. According to Dr. Michael L. Furcolow of the University of Kansas Medical Center, about 500,000 new infections develop each year. He says, "The reason for the delayed recognition of histoplasmosis is not that it is a new disease, but that symptoms resemble such diversified common illnesses as influenza and tuberculosis."

An attack of histoplasmosis begins innocently enough. The patient may feel more tired than usual, a little achey, feverish, nothing startling. There may be a slight cough or the cough may come later. These symptoms are usually of short duration but sometimes last as long as six to

eight weeks. If X rays of the lungs are taken at this time the doctor can find abnormal shadows in about one-third of the cases. In children the disease may be more serious at this time as it begins a steady march through the lungs and the rest of the body.

In the early stages, however, in most adults, the disease is relatively mild. In some, however, there is later a turn for the worse as some areas of the lungs break down and develop cavities resembling those of advanced tuberculosis. Cough and expectoration increases. Some cases are fatal.

Yet, even now, there are effective ways of controlling this terrible disease. Simply enough, if the doctor thinks of it, histoplasmosis can usually be distinguished from tuberculosis by a harmless skin test. In tuberculosis the *tuberculin* test is *positive*. In histoplasmosis the *tuberculin* test is usually *negative* and the *histoplasmin* skin test is *positive*. Rarely a patient may have both diseases.

In addition to the skin test, doctors can get other clues to the diagnosis from the medical history. The soil containing the fungus has usually become infected or contaminated by droppings from starlings, chickens, other birds and bats. Epidemics have been caused by workers cleaning up public parks, chicken coops and belfrys, as they raked or shoveled the contaminated dirt into containers. The absence of contact with a person who has had tuberculosis is a valuable clue. Certain blood tests and sputum examinations are also helpful when the doctor is in doubt.

As for treatment, the great majority of cases go on to spontaneous healing as the body mobilizes some of its calcium resources to trap the infecting fungus in tiny chalk-like "prisons."

In severe cases of histoplasmosis where progress is unfavorable doctors can use an antibiotic derived from another fungus to fight the infection. This antibiotic is called amphotericin B and it is produced by a strain of *Streptomyces nodosus* isolated from soil obtained in the Orinoco Valley of Venezuela. Amphotericin B is a potent drug against many different fungi, and it must be administered intravenously. Doctors are cautioned to use it carefully and wisely, because it is so potent that it may have toxic effects on the blood, liver or kidneys.

Inhaled in the air

Another treacherous fungus is the one that causes San Joaquin Valley fever, a disease that doctors recognize under the improbable, tongue-twisting name of *Coccidioidomycosis*. The spores of this fungus, *Coccidioides immitis*, lie dormant in the sage and desert sand, especially in areas of southern California, Arizona and Nevada. Blown around by the wind, they are inhaled in the dust-polluted air.

In most cases the infection is so minor that the patient is hardly aware of it; a positive *coccidioidin* skin test is the only evidence of the victim's having been infected.

Other persons come down with symptoms suggestive of influenza, and if X rays of the chest are taken, the doctor may (or may not) find a few scattered patchy shadows. More often than not the patchy shadows develop later after the acute symp-

Fungus infections can be so deceptive as to indicate tuberculosis or influenza.

toms are gone. Indeed, the X ray may show vague changes long after the person has left the San Joaquin Valley area.

To avoid a mistake in diagnosis, the doctor must search into the patient's past, his travels and his vacations, to pick up helpful clues.

In mild cases of coccidioidomycosis no treatment is necessary because the patient gets better all by himself. However, in those cases where the disease progresses to the skin, bones and nervous system, amphotericin B may have to be used. Although its action is not quite as potent in these cases as it is in histoplasmosis, its use by doctors when the chips were down has saved many a life.

Just how deceptive fungus infections are can best be illustrated by the case of a 26-year-old mother of two boys, who was admitted to a tuberculosis sanatorium not long ago because her cough had persisted for over three weeks in spite of the usual remedies. An X ray revealed a shadow in the upper part of her right lung that the doctors believed could only be due to tuberculosis.

They made repeated tests on her sputum but, as the weeks rolled by, and more and more sputums were found free of tuberculosis germs, the doctors began to doubt the X ray diagnosis. What was even more disheartening was that the patient developed fluid on her right lung and appeared to be losing ground even with all the care that the doctors could give her at the sanatorium.

Close inspection of the fluid and further bacteriologic tests confirmed the diagnosis of actinomycosis, a fungus infection still too commonly confused with tuberculosis.

The fungus in this case is *Actinomyces bovis*. Just how this disease gets into the lungs is still not known for certain, but it does cause draining sinuses of the chest wall, the neck glands and even abdominal areas. This fungus grows best where the oxygen concentration is low.

Unlike most of the other fungus infections, actinomycosis can be treated most effectively by *penicillin*. The patient has to be given from one to six million units daily, and doctors usually continue treatment until all of the infected areas are cleaned up. This may require many months and, in some cases, surgical removal of the infected areas helps.

Although there are more than a dozen different fungus infections that can cause serious disease and even death, only about half of them are common enough to baffle or worry the average doctor. One of the more common ones is called *Blastomycosis* and it comes in both a North American and South American variety.

North American blastomycosis is apparently contacted from soil and, like the others is inhaled, through contaminated dust. In some cases the disease starts as a severe fungus infection of the skin and then spreads through the body. Skin tests and X rays are not much help. In the lungs the X rays may mimic pneumonia, cancer or tuberculosis. The only certain way of making the diag-

nosis is to trap the fungus and grow it in a culture. Skin tests and blood tests have not yet been perfected to such an extent that they can be considered reliable.

Whether the disease starts on the skin or in the lungs it hardly ever stops spontaneously and is unlike histoplasmosis or coccidiomycosis in that respect. Instead, once it starts it begins a relentless march through the body and it is capable of attacking almost every organ.

Penicillin and other common antibiotics can't stop the disease. The most useful drugs are amphotericin B and 2-hydroxystilbamidine. Since cures of blastomycosis are not too common, it is fortunate for humanity that the disease, as yet, is not more widespread than it is.

'Opportunistic' fungi

Sometimes fungi invade when the body has already been weakened by some other disease or when the immune balance of the body is altered by antibiotics or drugs. Fungi that are not ordinarily invasive but which can seize the *chance* to invade when conditions are right are called "opportunistic" for obvious reasons.

According to John F. Murray, M.D., associate professor of medicine, University of California, San Francisco Medical Center, "Several common diseases like diabetes mellitus, leukemia, lymphoma and cancer are known to predispose to opportunistic infections. Also associated with high incidence are less frequent disorders like aplastic anemia, collagen diseases, Cushing's syndrome and pulmonary alveolar proteinosis."

Sometimes when the patient is suffering from cancer or a serious infection the doctor has to use strong remedies to save the patient's life. Yet, even as he is administering the life-saving drug, the patient's resistance may be changing, opening the door of invasion by fungi that might otherwise be considered harmless.

There are many fungi on the skin, in the intestines and around us in the air that are naturally resisted by the body. But these basic immune processes can be impaired by X ray treatments, anti-cancer drugs and other therapies that suppress immunity. The result unfortunately may be enhanced susceptibility to fungus infection.

Here too it is sometimes difficult to decide whether the fungus that is picked up in a culture is merely a chance visitor or an "opportunist" that has already begun to invade and do its dirty work. Diseases by the odd names of *candidiasis, aspergillosis* and *moniliasis* are often caused by harmless fungi that have suddenly grown tough. In some cases treatment may have to be radically altered to drive out the new invaders.

Although fungus diseases are often baffling and may be difficult to cure, medical science is making progress against them. New antibiotics are constantly being developed that are less hazardous and more effective. Blood tests are constantly being improved. Immunology is becoming a precise science. The electron microscope is helping doctors understand how fungus invasion starts. Fortunate too is the high degree of resistance that the body naturally has to keep out so many of the fungus infections that would otherwise kill us. ■

Portrait of an assassin

A PROSPECTIVE presidential assassin is a young Caucasian male of small physical size with a background of extreme resentment, loneliness and serious emotional disturbance, two *Stanford University* psychiatrists report in *Science*. Dr. Marshall F. Gilula and Dr. David N. Daniels studied the eight assassination attempts on American presidents, four of them successful, and found the same factors in all.

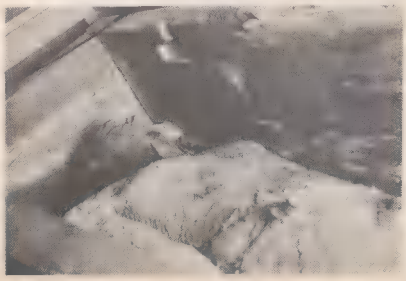
Typically, they report, the presidential assassin struggles for importance, success and manliness, but fails. At the time of the assassination, he is on a downward path which he hopes to reverse by shooting the president—providing instant satisfaction for his need for personal importance. His escape plans are inadequate or non-existent, apparently because he fantasizes that public opinion will vindicate his act.

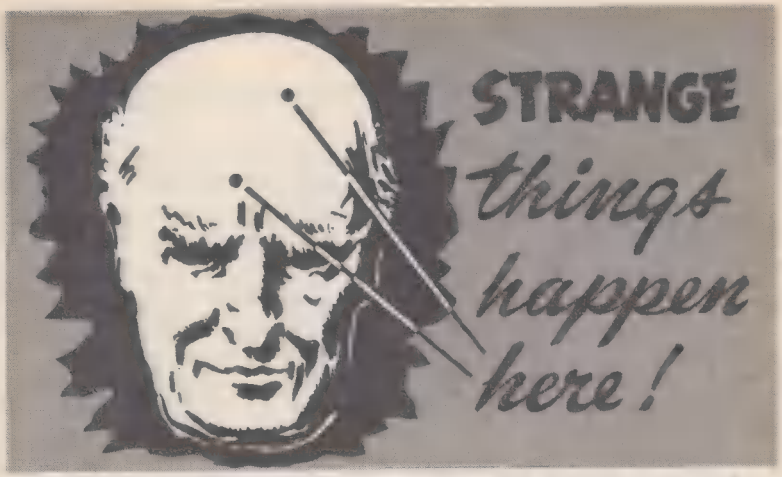
The assassin's act may be triggered by the fatalistic attitude of his victim, Gilula and Daniels indicate. Presidential nominee Robert Kennedy's comment, "If they want you, they can get you," typifies this group, which includes Abraham Lincoln and John F. Kennedy, as well as Martin Luther King Jr. Comment the psychiatrists: "Men who repeatedly and publicly proclaim their vulnerability may be unwittingly encouraging assassination by offering an invitation to the delusional, grandiose and isolated person who dreams of accomplishing at least one important and publicly recognized act in his life."

Stars from cosmic clumps

Stars are born when cosmic rays and weak magnetic fields combine to push gases in our galaxy into clumps, says a *University of Chicago* astrophysicist, Eugene N. Parker. Over a period of 200 million years or more, the clumps contract to form stars. "We know that a very weak magnetic field is tied to gases in the galaxy," explains Parker. "This field traps cosmic rays and both then exert pressure on gas."

Nefer, a 4500-year-old mummy, was a 5th dynasty Egyptian official. Still entombed in its original burial spot near the ancient step-pyramid of Zoser at Sakkara, Egypt, the mummy appears to be in near perfect condition. The picture and X ray of Nefer, above, were taken by scientists at the University of Michigan School of Dentistry, making Nefer the oldest mummy ever X rayed.





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Exploring the oceans for man's future

The New World of the Oceans. Daniel Behrman. Little, Brown. ($8.95).

Nowadays, explorers and scientists all over the world are turning their attention to the seas as the possible salvation for mankind. Add to this the fact that there is almost no place on this planet left to explore except the sea, and you have the principal reasons behind our current plunge in the oceans. (See "Fascinating new careers in oceanography," page 61 this issue.)

Every day the papers tell of some new oceanographic or sea-bottom probe, from projects like "Habitat" to university-sponsored ventures aimed at solving the mysteries of continental drift, ocean currents and weather phenomena.

For most people, the piecemeal reports from the domain of Neptune are a kaleidoscope of confusing and often contradictory information.

The author of this book has done a very neat thing—and he's done it well. Daniel Behrman claims no expertese in oceanography. He is an interested observer, who has gone to every center of oceanographic research, talked with the experts to see what they were doing, and correlated the whole into one massive cohesive program.

The reader travels with him to Scripps, in California; to Woods Hole and Lamont on the East Coast. He rides on "Flip"—the tip-up oceanographic vessel and goes all the way from the birth to the death of Project Mohole. All the outstanding theories that oceanographers have been working on are brought up to date. So are a number of far-out concepts, such as the Scripps' engineer's idea of towing polar icebergs down to Los Angeles to solve the water and irrigation problem. The career of the *Alvin* is spelled out in detail, including her successful dive for the lost atom bomb off the coast of Spain; the progress of experiments in adapting mammals—including man—to breathe water is all here (they're getting close). Fascinating military projects for sea-bottom salvage include weird deep-sea vehicles, even stranger diving bells and giant steel balls that are filled with gas to raise sunken hulks as big as ocean liners. Interesting experiments that never had much publicity are covered, as well—such as Woods Hole's "sea spider"—a stable platform for instruments that was lashed to the sea bottom.

The author winds up with an emphatic summary of pollution hazards; the importance of the seas to the future of mankind; the need for international controls to preserve this great reservoir of natural resource for our future—if we are to have a future.

For anyone who wonders how all the pieces of the oceanographic jigsaw puzzle fit together, this big, 436-page volume will do it for him. Furthermore, every page is filled with fascinating information, much of which will be new to many people

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who haven't kept up with the subject. And the book is nicely illustrated. —*RFD*

Other new books of interest

Photosynthesis. Isaac Asimov. Basic Books. ($5.95). Another in the Science & Discovery series, this one explains photosynthesis, the process upon which all life is dependent. It is written by one of science's cleverest and most prolific writers. (See "Fiction-writing scientists," page 38 this issue.)

Twentieth Century Discovery. Isaac Asimov. Doubleday. ($4.95). Dr. Asimov offers us another of his lively and enjoyable looks at science—this time tackling the vast technological advances and changes that have occurred during the 20th century.

Analyzing Children's Art. Rhoda Kellog. The National Press. ($8.95). The author, who has been studying children's drawings for 20 years, brings another interesting study of what children's art means. The theme of this book is that though each child's art is individual, there is a developmental sequence common to children all over the world. The book is well-documented with some of the half-million drawings the author has collected.

Exploring Crystals. James Berry. Crowell-Collier. ($4.50). The latest facts about crystals as well as experiments that the reader can do at home are here and written to answer any questions the young student might have about these flowers of the mineral kingdom.

Worlds Around the Sun. Lee Edson. Published by American Heritage in collaboration with the Smithsonian Institution. ($4.95). The sixth volume in the Smithsonian Library series is just like the previous ones—excellent. Once again, following the same format, this edition has numerous beautiful color and black and white illustrations, a well-written text and superlative appendices. It's certainly worth buying—especially at the price.

A Biographical Dictionary of Scientists. Edited by Trevor I. Williams. John Wiley & Sons. ($9.95). Designed for the general reader as well as the serious student, the dictionary gives the basics for over 1,000 historical scientists—none living today.

Bird Song: Acoustics and Physiology. Crawford H. Greenewalt. Smithsonian Institution Press. ($12.50). A good choice for the serious student of birds, this attractively-produced book delves into bird song a little too deeply for the average bird lover. The style of writing is not overly scholarly, however, and the many illustrations are helpful. A discussion of the acoustics of talking birds, on which little has been written, is particularly interesting. Two phonograph records of bird songs are included.

Vertebrate Adaptations. W. H. Freeman and Company. (Clothbound, $10.00, Paperbound $5.45). How do horses run? What governs an animal's heart rate? How do seals keep warm? What keeps a camel from getting thirsty? You can find the answers to these and other intriguing questions about the adaptations of vertebrate animals, including man, in this oversized, profusely-illustrated volume. A compilation of recent articles from the magazine *Scientific American,* it's readable as well as informative, although a bit on the technical side. A book you'll enjoy —and keep.

The World of the Red Fox. Leonard Lee Rue III. J. B. Lippincott Co. ($5.95). Part of the Living World Series of books, this documentary on the red fox provides both good reading and enjoyable looking. The illustrations are numerous and good, and the author, who has spent over 30 years studying and photographing this fox, tells some fascinating tales.

The Excavations at Helwan. Zaki Y. Saad. University of Oklahoma Press. ($6.95). What were the Egyptians from the First and Second Dynasties (from about 3200 B.C.) really like? Here is a story of their architecture, art, culture, communications and religion—from a man who has spent his life studying Egypt and who spent 12 years unearthing over 10,000 Egyptian tombs and in so doing, discovering untold archaeological wealth.

What's Left: Reports on a Diminishing America. Berton Roueche. Little, Brown and Co. ($5.95). This true-life story of a naturalist's trek across America is very exciting and at the same time, very depressing. The excitement lies in the marvelous experiences he has in many of the relatively untouched regions of this country. The depression results from the discoveries he makes along the way—how this natural land is being "developed" to death in the name of progress and without much thought for man or animal.

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Letters to the Editor

'Youth pill' error

I presented a discussion, a scientific one, on the use of estrogen in the climacteric female (reported in "Bulletins at Press Time," March 1969). The term "youth pill" was applied by the authorities at the medical school at the University of California at Los Angeles. They were not my words. However, I did not discuss KH3 or any compound like it. It is my firm belief that KH3 is nothing more than a high class placebo, not to be of any benefit in the human. The work that has been performed is completely unreliable, poorly controlled and has not been substantiated by critical studies.

HERBERT S. KUPPERMAN, M.D., PH.D.
Associate Professor of Medicine
New York University Medical Center

In the brief item on KH3, appearing in "Bulletins" we had summarized a report that appeared in a West Coast magazine. Evidently that report was in serious error. Our apologies to Dr. Kupperman.—Ed.

Pot heads worst soldiers

In regard to your article on the use of "*con xa*" *in* Vietnam, ("The Vietcong's sercet weapon: marijuana," April 1969), I've found that it is not the best soldiers in a company who smoke pot the most, but the worst. We have three "pot heads" in my outfit. I've seen one with a plastic bag with 10 reefers in it. They are the most irresponsible people in the detachment. I myself do not indulge in *con xa* and have no intention of doing so. A Bach cantata is enough for me to relax.

SP/4 RODNEY P. KESEL
APO San Francisco

Runestone controversy

The editors of Science Digest have read with great interest the many letters we have received concerning the article, "Riddle of the Viking cryptograms," which appeared in the January 1969 issue. Many readers have offered their interpretations of the Heavener and Poteau Runestones. While we cannot possibly print all letters received or all we have chosen in their entirety, here are some of responses we had.—Ed.

The January, 1969 article on the "Riddle of the Viking cryptograms" found in Oklahoma brings up memories of things read years ago. Early books on American Indians mentioned that the Algonquin Indians of the East Coast looked like Scandinavians, and when the first Norwegians came, each could understand the other's language. Nobody today can prove whether this is true or not. But if true, it could certainly help explain the Oklahoma Viking runes.

Let us assume that early Vikings came to North America and settled. The men interbred with local Indians, but retained their native language. Many years, or decades later, other Vikings came and met the Algonquins who could understand their language. The Algonquins may have

lost the art of writing, but the new arrivals had not. The Vikings and Algonquins "conjured" up an expedition to the interior of the new lands.

On the western trek the explorers tried to leave signs or landmarks for others to follow. But only the ones in Oklahoma have been found. There must be plenty of others.

The history of the American Indians is fascinating to archaeologists and anthropologists, but the history may never be satisfactorily explained. For example, the Mandan Indians of the Dakotas are light skinned. Are they descendants of the early Vikings? Did their ancestors chisel the Viking runes? Does their native language contain any Scandinavian root words? This is important.

CORLEY MCDARMENT
Eau Gallie, Fla.

Thank you for the article, "Riddle of the Viking cryptograms," by Mark Roberts. What an absorbing brain teaser. Even if the experts may disagree with the many interpretations you are bound to receive as a result of this intriguing invitation to "solve" the runestone mystery, the readers have had an interesting (if haunting) few days or weeks.

JUNE OTT
Walla Walla, Wash.

May I offer a possible change in a few words of the Kensington Stone translation found on page 10 of your runestone article. Line one says "8 Goths and . . . ." I would say "8 youths and . . ." because the word "goter" reminds me of a Norwegian word for boy of kid or youth in a plural sense. The letter o sounds nearly like the u in burn. It makes more sense to have eight youths as cabin boys and apprentice seamen than Goths from a rival community or nation.

HOWARD A. GUNDERSON
Plymouth Meeting, Pa.

Your treatment of the runestone riddle was interesting, and so was your hypothesis that cryptography was involved. This is always a good speculation, gains interest and, of course, may in any instance be correct. However, at least some experience in deciphering ancient documents relating to mines, and subsequently being satisfied with the translations, I believe that the big difficulty is in the constant changing of the language (any) and the difference in the choice of works between geographi-

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JOHNANNA SCHOUTEN
Las Vegas, Nev.

Reading the fascinating article [runestones], I was almost sure the Oklahoma stones were recent fakes. But when I went on to study the tests, my opinion was reversed. I see it as a real discovery of a forgotten explorer—Lademund Ong ("Hook"), the Frisian who reached Oklahoma and perhaps Mexico in about A.D. 600. It seems to me they are genuine. A forger would not have used so old a futhark and would have made his message more relevant to the known Vikings.

PAUL K. JOHNSTONE
St. Louis, Mo.

The runic script on the Oklahoma runestones at Poteau and Heavener tends to support a theory that this expedition originated directly from Cotland, Sweden (island in the Baltic Sea). There is no way of knowing the exact date, but experts can come up with an approximate date of when this type of writing was discontinued. Of course, we cannot discount completely the idea that the Swedish captain (or member of his crew) knew how to write in runic letters and that they were written in 1718-20 when a portion of John Law's French expedition of the Mississippi Valley entered the Arkansas River area.

HELEN LOMICKA
Rochester, N.Y.

Whether my translations of the Heavener and Poteau Runestones are of any consequence or not, I have very much enjoyed doing them and being an avid reader of your magazine. I do hope you will have more of these stimulating problems in your future issues.

PAUL R. TANSEY
Miami Beach, Fla.

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Pictorial Parade

An eye-opening experience

THE KEEPERS in the reptile house at the Mountain Zoo in Wales had noticed for several weeks that something was wrong with one of their alligators. They called in Welsh veterinary surgeon Dr. Medwyn Humphreys to examine the reptile.

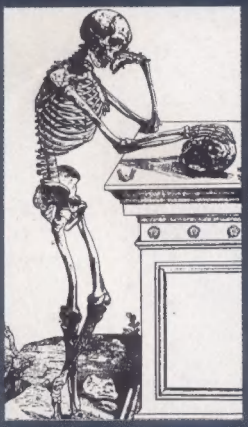
Right away the vet spotted a large tumor on the reptile's left eye. It had grown on the animal's transparent third eyelid—the one that covers the eye underwater. After a brief consultation with zoo officials, it was decided that an operation was necessary.

Dr. Humphreys took the alligator to his office and proceeded with the difficult task of eye surgery on a giant reptile.

He decided that the animal should not be put to sleep during the operation. Instead a local anesthetic was used—the alligator was awake during the whole operation. The veterinarian and his assistant had to wrap strips of gauze bandages around the animal's snout to restrain its enormous jaws.

The alligator came through the ordeal with flying colors—above the eye is being opened for the first time since the operation. With sight restored, the alligator can look forward to a long life in the Welsh zoo.

ADVENTURES IN



Science & Discovery

IN THIS ISSUE

Old bones that speak loud and clear
Many a crime, old and new, has been solved by anthropologists who know how to "read" bones. See page 30.

Population explosions
Are insects shouting a warning of mass starvation? Some scientists think so. Starvation may be the only way to control human population. Page 40.

Oceanography careers
The excitement and adventure of the world of "inner space" is luring many of the most gifted young scientists. Find out about YOUR opportunities on page 61.